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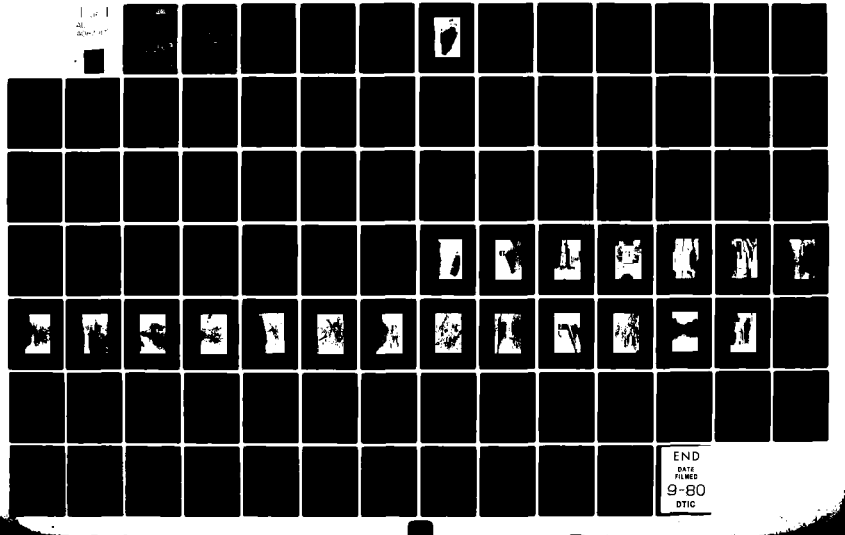

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LEVEL II

DELAWARE RIVER BASIN
PINE CREEK, SCHUYLKILL COUNTY
PENNSYLVANIA
NDS ID PA. 00742
DER ID 54-60

LAKESIDE DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

WOODWARD-CLYDE CONSULTANTS
DACW31-80-C-0018

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JUNE 1980

(6) National Dam Inspection Program
Lakeside Dam

(1)

DELAWARE RIVER BASIN,
Pine Creek
~~LAKESIDE DAM~~, SCHUYLKILL COUNTY,
PENNSYLVANIA

NDS I.D. ~~NO.~~ PA 00742,
DER I.D. ~~NO.~~ 54-60,
Number

PHASE I INSPECTION REPORT
NATIONAL DAM ~~INSPECTION PROGRAM~~

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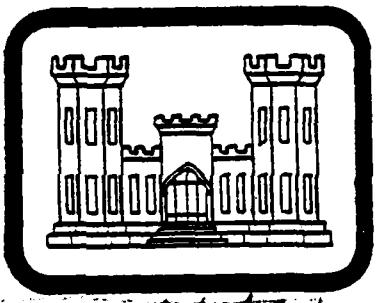

(15) DACW31-80-C-0018

Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JUNE 1980

SM 157

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to expeditiously identify those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Lakeside Dam
County Located:	Schuylkill County
State Located:	Pennsylvania
Stream:	Pine Creek
Coordinates:	Latitude 40° 48.8'
	Longitude 76° 28.8'
Date of Inspection:	May 6, 1980

Lakeside Dam is privately owned, and the reservoir is used for recreational purposes. The dam and spillway structures are currently in poor condition.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Small" size dam and "Significant" hazard classification is the 100 Year Flood to one-half the Probable Maximum Flood (PMF). Based on the damage center located 2,000 feet downstream of the dam, the one-half PMF event has been selected as the spillway design flood.

Hydrologic and hydraulic computations presented in Appendix D indicate that the spillway structure is capable of discharging less than 0.1 PMF without overtopping the embankment. As the structure will not discharge the spillway design flood without overtopping the embankment, it is considered to have an "Inadequate" spillway.

It is recommended that the following measures be taken immediately. Items (1) through (3) should be performed under the supervision of a registered professional engineer experienced in the design and construction of dams.

(1) A hydrologic/hydraulic study should be made to determine the best method of increasing the spillway capacity to meet current hydrologic/hydraulic criteria.

(2) A study should be made to determine the structural integrity of the left spillway timber flume and the timber spillway.

(3) Seepage through the dam should be monitored for increase in volume and for development of turbidity.

(4) All brush growing on the downstream slope should be removed.

Because of the potential for property damage and loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented for this facility. An operation and maintenance procedure, including a checklist of items to be inspected regularly, should be formalized and implemented to insure that all items are inspected on a regular basis and the embankment and appurtenances are maintained in the best possible condition.

Mary F. Beck — 6/30/80

Mary F. Beck, P.E.
Pennsylvania Registration 27447E
Woodward-Clyde Consultants

Date

6/30/80

John H. Frederick, Jr., P.E.
Maryland Registration 7301
Woodward-Clyde Consultants

Date

APPROVED BY:

31 JAG 1980

Date

OVERVIEW
LAKESIDE DAM, SCHUYLKILL COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKESIDE DAM
NATIONAL ID NO. PA 00742
DER NO. 54-60

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lakeside Dam is a timber crib and earth fill dam, approximately 10.5 feet high, across Pine Creek. The approximately 435 foot long dam impounds an estimated 93 acre-foot reservoir with the water surface at the top of the dam within a total drainage basin of approximately 5.33 square miles. The dam was constructed as a timber crib structure, with earth and rock fill on both the upstream and downstream faces. The upstream face of the dam is covered with sand for use as a bathing beach. Railroad ties were placed on the upstream face for wave protection during the summer when the reservoir level is raised. The upstream face of the dam is shown on Photograph 9, Appendix C. Portions of the downstream face of the dam are nearly vertical with placed rock fill and remnants of timber cribbing visible, while, as shown in Photographs 12 and 13, other portions have flatter slopes with soil and rock fill. Based on a water surface elevation in the lake of 1,071.0 at the time of the inspection, the crest elevations of the dam range from 1,074.5 in the right abutment area, 1,074.3 at the upstream edge of the bridge over the timber spillway, 1,074.8 near the dam midpoint to 1,076.8 near the left abutment. The dam crest is approximately 20 feet wide.

Three spillways discharge water from the reservoir. For this report, the spillways will be denoted as the left spillway, timber spillway and right spillway. The left

spillway at the left end of the dam has concrete entrance walls with stoplogs at elevations 1,072.4 and 1,072.8. A timber flume about 10 feet wide and 50 feet long abuts the concrete entrance walls in the left abutment area downstream of the dam (see Photographs 5 and 6). The timber spillway is near the right end of the dam, shown in Photographs 1, 2, 3, 4 and 17. The crest of the original timber crib spillway is at elevation 1,071.8. Vertical timber sheeting with a crest elevation of 1,073.3 at the upstream side of the spillway prevents water from flowing over this spillway. Immediately to the right of the timber spillway is a chute or sluiceway of timber construction approximately four feet wide. Flow through the chute is regulated by stoplogs. A wooden deck crosses the timber spillway and chute, permitting access to the bathing beach at the left end of the dam. The right spillway is a concrete channel approximately eight feet wide at about elevation 1,073.4. A footbridge crosses the right spillway. The spillway discharges into a broad shallow channel at the right abutment of the dam (Photograph 8).

b. Location. The dam is located approximately 1,000 feet east of State Route 54, where it crosses over Hosensock Creek in Ryan Township, Schuylkill County, Pennsylvania. The dam site and reservoir are shown on the USGS Quadrangle entitled "Delano, Pennsylvania" at coordinates N 40° 48.8' W 76° 2.8'. A regional location plan is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as a "Small" size structure by virtue of its 10.5 foot height and estimated 93 acre-foot total storage capacity.

d. Hazard Classification. A "Significant" hazard classification is assigned consistent with the potential for appreciable property damage, but with few or no lives lost.

e. Ownership. The dam is owned by Mr. Edmund J. McGrath. All correspondence should be addressed to Mr. McGrath at 40½ West Center Street, Mahanoy City, Pennsylvania 17948.

f. Purpose of Dam. The dam and reservoir are used for recreational purposes.

g. Design and Construction History. Lakeside Dam was built in the period between 1889 and 1901 as a timber crib structure with earth fill on the upstream side and rock fill on the downstream side. In conjunction with another dam and reservoir immediately downstream, Lakeside Dam reservoir was operated for ice production. Handling facilities and the ice storage house were located at the right end of the dam.

The original 1915 state inspection report lists the dam as approximately 350 feet long, 20 feet wide at the crest, and having a maximum height of 12 feet. The upstream slope was 2H:1V and the downstream slope was 1.5H:1V, resulting in a maximum base width of about 60 feet. Earth fill covered the original timber crest of the dam, and the dam was described as essentially an earth and rock fill structure. The dam was apparently intended as an overflow structure because the crest was timbered with an angled timber deck. A flood overflow capacity of 2,240 cfs was calculated for a depth of water of 1.85 feet over the dam crest. Such an overflow was concluded to be "not likely to cause erosion".

There were several spillway outlets from the reservoir. At the left side of the dam there was a timber sluice gate four feet deep and ten feet wide. A photograph of this area, located in Department of Environmental Resources (DER) files, shows unmortared stone entrance walls to this spillway. This discharged into a waste channel, discharging water around the lower dam and reservoir. A capacity of 200 cfs was reported for this spillway and was thought to be adequate to accommodate ordinary flood discharges. A timber crib spillway section, 20 feet wide and one foot below the crest of the dam, was located at the right end of the dam.

Immediately to the right of the timber crib spillway there was a sluice gate (chute), 4.5 feet wide and 12 feet deep, where water flow was regulated by stoplogs. The right wall immediately downstream from the chute was constructed of stone masonry and formed a portion of the ice house structure.

Subsequent letters and state inspections of this dam frequently cited the need for maintenance and repairs. The downstream toe of the dam was frequently observed to be submerged in the pond behind the lower dam (no longer existing). Leakage was frequently observed through Lakeside Dam, particularly at the overflow section of the timber crib spillway. The crest of the dam was in need of repair due to its uneven condition as a result of recent filling and erosion, and the plank section was also in need of repair. Apparently, this dam was frequently overtopped.

In 1924, as a result of repairs, the crest of the dam was filled to an approximately uniform elevation. An inspection report in 1926 noted that extensive repairs were recently made, including new fill on the crest of the dam and the upstream slope. Leakage through the dam appeared to be significantly less, if not stopped.

Lakeside Dam was noted to be in generally poor condition and showed evidence of poor maintenance in an

inspection in 1930. The timber decking observed in photographs from 1915 on the crest of the dam was no longer present. The downstream face was loose shale rock, which would have questionable stability during an overtopping event. The spillway openings in the dam were retimbered and remeasured. The overflow section of the timber spillway at the right end of the dam was 21.2 feet wide and 1.1 feet below the dam crest. Other unspecified spillways were 2.4 feet wide by 1.7 feet high and 4.0 feet wide by 1.4 feet high. The latter of these dimensions may be the chute, with the shallow depth being measured to a stoplog. A raceway at the left end of the dam was 12.4 feet wide. Several small streams flowed from beneath the dam, particularly in the vicinity of the spillway section.

Subsequent inspection reports generally noted a poor physical appearance and evidence of poor to fair maintenance of the dam. At times, leakage was observed through the dam, particularly the right portion of the dam near the overflow spillway, and the left downstream abutment area. At other times, water in the lower pond obscured the downstream toe conditions of Lakeside Dam. In 1932, some additional fill was believed to have been placed downstream at the left end of the dam and more filling in this area was proposed. According to the Owner, the fill was placed to extend the beach by five feet and no other changes to the dam were made.

A memo in 1933 refers to a recent storm in which the lower dam was washed out and Lakeside Dam was overtopped. During this episode, Lakeside Dam sustained minor damage, and evidence of erosion was observed at both ends of the dam on the downstream face. There are drawings in DER files, dated 1933, which show modifications to the dam and a new spillway. However, there is no documentation referring to these drawings, nor were the indicated facilities ever built.

Inspection reports subsequent to 1934, frequently noted streams of water leaking through and beneath the dam, particularly the right end, and around the chute and the overflow spillway. In 1938, a new timber bridge over the timber spillway was noted.

During Tropical Storm Agnes in 1972, Lakeside Dam was overtopped. An inspection by state personnel in July of 1972, described the three spillways of the dam as being grossly inadequate. Recommendations were made for the removal of the dam or for the implementation of major repairs. It was suggested that a professional engineer examine the dam and make appropriate recommendations. A cost estimate prepared by R. F. Miller & Associates, engineers, identified work items

which needed to be done, including the construction of a reinforced concrete spillway, removal of portions of the existing dam and replacing these portions with properly constructed embankment.

Following Tropical Storm Agnes and subsequent inspections, the DER directed that Lakeside Dam be drawn down and that no water be impounded behind the dam until written notice was provided. An inspection in July 1973, disclosed that the lake was filled and new fill was added to the crest of the dam. This new fill was loosely placed to fill in erosion damage from the Agnes overtopping.

In August 1973, a memo from the Attorney General's office stated that legal action against Lakeside Dam was being started, but was not a high priority. Applications to draw down the lake were made in 1973 and 1974. Permits to draw down the lake were granted in both of these years with the added stipulation that no water be impounded behind Lakeside Dam unless written permission was granted from DER. There is no further documented history of the dam since September 1974.

h. Normal Operating Procedures. Under normal operating procedures, stoplogs are placed in the timber spillway to raise the water level for the summer. Other than the summer season, the lake level is lowered as desired to permit cleaning of the beach area and whatever repairs are deemed necessary by the Owner.

1.3 Pertinent Data.

A summary of pertinent data for Lakeside Dam and reservoir is presented as follows.

a.	Drainage Area (square miles)	5.3
b.	Discharge at Dam Site (cfs)	
	Maximum Spillway Capacity	231
	Maximum Flood	Unknown
	Minimum Required Flow	Unknown
c.	Elevations (feet above MSL)[1]	
	Top of Dam	
	Minimum Crest Elevation	1,074.8
	Minimum Abutment Elevation	1,074.5

(1) Water surface elevation assumed to be 1,071.0 from USGS map. All other elevations are relative to this elevation.

	Spillway Crest Elevations	
	Left Spillway	1,072.8
	Summer Normal Pool	1,072.4
	Timber Spillway	
	Upstream Timber Sheeting	1,073.3
	Downstream Weir	1,071.8
	Right Spillway	1,073.4±
	Concrete Apron Downstream of Timber Spillway	1,064.3
d.	Reservoir (feet)	
	Length at Normal Pool	1,000
	Length at Maximum Pool (est)	1,200
e.	Storage (acre-feet)	
	Normal Pool (estimated)	60
	Top of Dam (estimated)	91
f.	Reservoir Surface (acres)	
	Normal Pool	12.5
g.	Dam Data	
	Type	Timber crib/earth covered
	Length	435 feet
	Height	10.5 feet
	Crest Width	20 feet
	Side Slopes	
	Upstream (est) Below the Railroad Ties	5H:1V
	Downstream	Vertical to 2H:1V
	Volume	6,000 cubic yards
	Cutoff	None known
h.	Spillways	
	Left Spillway	
	Type	Concrete with stoplogs abuting a timber flume
	Location	Left abutment
	Length	About 50 feet
	Elevations	1,072.4
		1,072.8
	Timber Spillway	
	Type	Timber crib structure with upstream vertical timber wall and adjacent chute controlled by stoplogs

Location	Near right abutment
Length	About 25 feet
Width	
Upstream Vertical Wall and Stoplog Section	30 feet
Downstream Weir	23.5 feet
Chute	4.5± feet
Elevation	
Upstream Timber Wall	1,073.3
Downstream Weir	1,071.8
Right Spillway	
Type	Concrete channel discharging to a grassed swale
Location	Right abutment
Width	8 feet
Length	100 feet
Elevation	1,073.4±

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Availability. A summary of the engineering data is presented on the checklist attached as Appendix B. Principal documents containing pertinent data used for this report are limited to periodic state inspection reports, memos, correspondence and photographs. All of these data are contained within the Department of Environmental Resources (DER) files.

b. Design Features. A plan view, profile and section of the dam are presented in Appendix E. A summary of the design features is included in Section 1.3.

2.2 Construction.

Information concerning the construction of the dam is discussed in Section 1.2, paragraph g.

2.3 Operational Data.

There are no operational records maintained for this dam beyond the periodic applications for permits to draw the lake level down.

2.4 Evaluation.

a. Availability. All information presented herein was obtained from DER files and supplemented by conversations with the Owner.

b. Adequacy. The available data are not adequate to evaluate the engineering aspects of this dam.

c. Validity. There is no reason to question the validity of the limited available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist presented in Appendix A and are summarized and evaluated in the following subsections. In general, the appearance of the facilities indicates that the dam is currently in poor condition and not well maintained.

b. Dam. The vertical alignment of the dam crest was checked, and the profile is shown on Plate 3, Appendix E. Although the vertical profile is uneven, there appears to be no distortions in alignment or grade that would be indicative of deep-seated movement of the embankment or foundation. The crest elevation ranges from 1,074.5 in the right abutment area, 1,074.3 at the upstream edge of the bridge over the timber spillway, 1,074.8 near the dam midpoint to 1,076.8 near the left abutment. The crest is approximately 20 feet wide, with a light to moderate growth of grass, and occasional vestiges of the timber cribbing of the dam protruding through the crest, as shown on Photographs 10 and 11. The timber is believed to represent a former downstream edge of the dam crest. As shown in Photograph 9, a 1.0 to 1.5 foot high wall of railroad ties is located above the gentle slope of the upstream face of the dam. The ties were reportedly placed for wave protection. The visible upstream slope of the dam appears to be a moderate to gently sloping sand beach area.

The downstream face of the dam, as shown on Photographs 12 and 13, has a variable appearance. Areas are composed of apparently nearly vertical hand placed shale rock with vestiges of the former timber cribbing. Also along the downstream face of the dam are conical shaped areas of apparent earth fill, supporting growths of weeds and brush. The slope of these earth fill zones is estimated to be 2H:1V. The junctures between the embankment and the abutments appear to be in generally good condition.

There is seepage from beneath the toe of the dam at one location, as shown by Photograph 15. The area immediately downstream of the dam is generally soft and marshy, and sustains vegetative growth that is associated with marshy conditions. There are several nonvegetated areas at the downstream toe that have the appearance of being locations of constant seepage.

c. Appurtenant Structures.

1. Spillway. The approach to the left spillway (Photograph 5) is formed by two concrete wingwalls, with the top of the left wingwall at a lower elevation than the right wingwall. Also, it appears that these wingwalls were constructed at different times, with the concrete closer to the spillway entrance being of much older construction. Also shown in Photograph 5 are the supports and some of the stoplogs used for raising the lake level during the summer. Downstream of the wingwalls, the spillway consists of a timber flume approximately ten feet wide, four feet high and 50 feet long. The flume is covered with a timber deck on which a small building that shows substantial evidence of differential settlement, tilting and other structural distortions is located. The downstream end of the spillway flume, as shown in Photograph 6, discharges into a plunge pool and then into a channel through the downstream left abutment area. Water is standing in the plunge pool, even though the lake level is below the spillway crest. As also shown in Photograph 6, there is considerable scour and erosion around the outlet of the flume.

As shown in Photographs 2 and 3, the timber spillway has two components - the timber crib overflow weir and the spillway chute. The chute in the timber spillway serves as the main water outlet from the reservoir when the reservoir level is lowered during the winter. The upstream vertical timber sheeting across most of the width of this spillway is braced against the footbridge supports and the downstream timber crib section (see Plate 4, Appendix E). One of the major vertical support posts was broken and consequently additional bracing has been installed. Small debris was collecting downstream of the vertical wall. To the right of this spillway, a concrete wall forms the upstream face of the dam. As shown in Photograph 1, the right upstream edge of the footbridge appears to have deflected downward. The opening between the top of the timber sheeting and the underside of the wooden bridge deck across the spillway is approximately one foot. The top of the timber crib structure is mostly covered with broken rock and gravel; however, timber planking is exposed near the weir crest on the downstream side. The timber planking slopes downward towards the upstream side of the dam. The gravel on top of the timber crib portion of the spillway is depressed, perhaps as the result of scour and erosion during periods of large flows. The chute to the right of the timber crib section appears to extend vertically downward almost to the downstream channel bed. The downstream outlet of the chute, as shown in Photograph 4, is distorted. This photograph also shows some of the interior timber bracing in the chute as well as deteriorating timber. The wooden

walls of the chute (Photograph 4) terminate at the bridge deck, Photographs 2 and 17.

Water discharged from the timber spillway flows onto broken concrete paving of the discharge channel, which is approximately the same elevation as the ground surface at the toe of the dam. The right wall of the discharge channel is partially formed by a stone masonry retaining wall. This wall appears to be in generally good condition. There is no evidence of mortar spalling, cracks or other deterioration to this wall.

The right spillway near the right abutment of the dam is a concrete channel approximately 1.7 feet deep and eight feet wide. The entrance to this spillway is shown in Photograph 7. A plank footbridge crosses the spillway. The left entrance wall to the spillway is undermined (Photograph 7). The right spillway discharges into a broad shallow grass-lined channel on the downstream right abutment of the dam that, after a distance of approximately 100 feet downstream from the dam, spills into Pine Creek.

d. Reservoir. Reservoir side slopes are flat to moderate, but with occasional moderate to steep slopes, particularly in the upstream right abutment area. The slopes are vegetated with trees, grass and brush to the water's edge, except at the sand bathing beach upstream at the left abutment area. On a subsequent visit to the dam, approximately one week after the initial inspection, the reservoir level was lowered several feet and a considerable amount of sediment at the upper end of the reservoir was observed. The USGS map indicates a reservoir surface area of 12.5 acres at elevation 1,071.

e. Downstream Channel. The downstream channel appears to be in generally good condition, with no accumulation of debris or other obstructions. Immediately downstream from the dam, the channel banks are moderately to heavily wooded.

The first damage center is located about 2,000 feet downstream of the dam at the location of an oil distributor. Oil storage tanks are located on the hill north of the creek, while the truck loading area is located south of the creek off of Pennsylvania Route 54. Supply lines from the oil tanks cross the creek at the top of the bank elevation. A home is adjacent to the oil distributor building. Several more houses are located about 1,500 feet farther downstream. These houses appear to be at slightly higher elevations than the general floodplain of the creek, but have garages and other outbuildings built adjacent to the stream area. It appears that the fuel oil distribution center, the neighboring house, and the

garages and outbuildings farther downstream are subject to damage in the event of large flows in the creek or from failure of the dam. Since no loss of life is envisioned, a "Significant" hazard classification for this structure is warranted.

3.2 Evaluation.

In summary, the visual inspection of the dam disclosed no evidence of incipient failure of the dam embankment. The dam embankment is judged to be in poor condition because of uncontrolled vegetation and the uneven appearance of the downstream face of the dam. The seepage noted and evidence of other seepage areas downstream from the dam are consistent with previous inspection reports. The seepage is assessed to represent an apparently long-term condition, which requires monitoring for development of turbidity or increase in flow.

The spillway structures, especially the timber structures, generally appear to be in poor condition. This evaluation is based upon the distortion and settlement observed on the building over the left spillway and by the condition of the timber spillway. Except for the erosion around the right spillway, the structure appears to be in good condition. It is assessed that the conditions of these timber spillway structures should be carefully examined, not only from the point of view of their safety as hydraulic structures, but also in the interest of the safety of persons using the dam for recreation.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Normal operating procedures of Lakeside Dam do not require a dam tender. Stoplogs are placed in the spillways to raise the water level for the summer, and normal flow is discharged first through the left spillway and then the timber spillway into Pine Creek. It is unknown if a minimum downstream flow is required.

4.2 Maintenance of the Dam.

There is no evidence of routine maintenance of the dam other than that which is necessary to operate the facility for commercial recreational uses. It is understood that the water level in the reservoir is periodically lowered to permit repairs, cleaning and refurbishing of the bathing beach area. During a subsequent visit to Lakeside Dam, it was observed that an additional layer of sheeting was being added to the timber spillway. Maintenance is provided by the Owner.

4.3 Maintenance of Operating Facilities.

The only operating facilities associated with this structure are the stoplogs located in the timber spillway. The Owner provides the required maintenance.

4.4 Warning Systems In Effect.

There are no formal warning systems or procedures established to be followed during periods of exceedingly heavy rainfall.

4.5 Evaluation.

There are no written operational procedures, maintenance procedures or any type of warning system. Maintenance and operating procedures should be developed, including a checklist of items to be observed, operated and inspected on a regular basis.

Since a formal warning procedure does not exist, one should be developed and implemented during periods of extreme rainfall. This procedure should consist of a method of notifying residents downstream that potentially high flows are imminent or dangerous conditions are developing.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design/Evaluation Data. There are no original design data for this structure. Subsequent evaluation data are limited to the expected depth of overtopping (see Section 1.2).

The watershed is small, about 50 percent wooded, and residential development is limited to less than 25 percent of the total area. The watershed is hydrologically complicated, containing two upstream dams and a railroad embankment that functions as a dam. About 2,500 feet upstream of Lakeside Reservoir along Hosensock Creek is Hosensock Dam, a flood control dam designed by the Soil Conservation Service. Hosensock Dam controls about 2.1 square miles of the total watershed. About 600 feet upstream of Lakeside Reservoir, also along Hosensock Creek, is Lakewood Dam. This dam is approximately 12 feet high, with limited freeboard and very little flood water storage. Lakewood Dam's total drainage area is about 2.9 square miles, including the upstream Hosensock Dam Watershed. Immediately upstream of Lakeside Reservoir along Hosensock Creek is Pennsylvania Route 54 and a railroad embankment, estimated to be about 30 feet high. Pine Creek enters Lakeside Reservoir from the north. Pine Creek drainage area totals about 2.43 square miles. Elevations range from an extreme of about 1,896 feet in the extreme upper reaches to 1,071 feet, the normal water surface elevation of Lakeside Reservoir. While some residential development has recently occurred in the watershed, runoff characteristics are not expected to change significantly in the near future.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Small" size dam and "Significant" hazard classification is the One Hundred Year Flood to one-half the Probable Maximum Flood (PMF). Based on the location of an oil distributor and a home about 2,000 feet downstream of the dam, the selected spillway design flood is one-half the PMF.

b. Experience Data. No reservoir level or rainfall records are maintained for this dam by the Owner. During Tropical Storm Agnes, 1972, the embankment was overtopped to an unknown depth, causing reports that the dam was failing. Maximum rainfalls reported by the National Weather Service during Tropical Storm Agnes were 5.1 inches in Mahanoy City and 5.28 inches in Tamaqua. Lakeside Dam is located approximately midway between these two weather stations.

c. Visual Observations. At the time of the inspection, a condition observed that might indicate a reduced spillway capacity during an extreme event is that all the spillways are very small and subject to blockage by debris. The Owner attributed the overtopping during Tropical Storm Agnes solely to the fact that the spillways were blocked by debris. Other observations regarding the condition of the downstream channel, spillway and reservoir are located in Appendix A and discussed in greater detail in Section 3.

d. Overtopping Potential. The overtopping potential of this dam was estimated using the HEC-1, Dam Safety Version, computer program. A brief description of the program is included in Appendix D. Calculations for this investigation indicate that the maximum spillway capacity without overtopping the right abutment area is about 231 cfs. The computed peak one-half PMF inflow is about 4,570 cfs. The output from the computer program indicates that the spillways are not capable of discharging 0.1 PMF without overtopping. During 0.1 PMF, the right abutment area is overtopped by about one foot, with the low point of the dam being between the timber spillway and the right spillway. The embankment itself will be overtopped by about 0.7 foot during a 0.1 PMF event. The above assumes no failures of upstream dams or the railroad embankment.

e. Spillway Adequacy. The spillway system for this structure is considered to be "Inadequate" as it will not pass the spillway design storm without overtopping the embankment.

f. Downstream Conditions. The first downstream damage center is located about 2,000 feet downstream of the dam at the location of an oil distributor. Oil storage tanks are located on the hill north of the creek, while the truck loading area is located south of the creek off of Pennsylvania Route 54. Supply lines from the oil tanks cross the creek at the top of the bank elevation. Adjacent to the oil distributor building is a home whose first floor is at approximately elevation 1,046.6. While the oil distributor building and home may be flooded and property damage may result from failure of the dam, loss of life is not envisioned. There are no other homes between the damage center and Little Schuylkill River, six miles downstream, that are assessed to experience an increase in damage or loss of life as a result of failure of Lakeside Dam. Therefore, a "Significant" hazard potential classification is warranted.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. Visual observations indicate no evidence of existing or pending embankment instability other than that which would result from overtopping. The visible portions of the upstream face of the dam appeared to be in good condition, and the downstream face of the dam appears to be in fair condition. The concrete entrance walls to the left spillway appear to be in good condition as well as the concrete channel of the right spillway. The timber flume at the left end of the dam and the timber spillway appear to be in poor condition. Distortion of the left spillway flume and timber spillway chute, together with broken bracing downstream of the vertical timber sheeting, is indicative of their poor condition. The channels downstream from the spillway structures are in good to fair condition.

A limited amount of seepage was observed during the visual inspection. However, there is evidence of considerably greater seepage from beneath the toe of the dam that is consistent with the previous inspection reports of this dam. The apparent clarity and long history of this seepage leads to the assessment that the seepage represents a long-term condition for this dam.

b. Design and Construction Data. No design or construction data are known to exist other than the observations and reports in the Department of Environmental Resources files. All data concerning the physical features of the dam were obtained from these reports and from visual observations of the dam.

c. Operating Procedures. No formal operating procedures currently exist.

d. Post-Construction Changes. As discussed in Section 1.2, paragraph g, and Section 3 of this report, several post-construction changes were made to Lakeside Dam. These modifications include the added concrete wingwalls at the left spillway, changes and modifications to the timber spillway, including the lowering of the weir crest (removal of flashboards), removal of the ice house facility, and construction of the concrete right spillway. Other changes include the periodic placement of fill on the crest of the dam. Most of these changes are documented as to approximate date through brief reports and photographs, but no drawings, calculations

or other engineering documentation of these changes are available.

e. Embankment Stability. There were no embankment stability evaluations in the files. Based on the visual observations and geometric configuration of the embankment, the dam appears to be stable at the present time, provided significant overtopping does not occur and seepage conditions do not change.

f. Seismic Stability. The dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. Since the dam is qualitatively assessed to be stable at the present time under static loading conditions, it can also reasonably be considered to be stable under seismic loading conditions.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. Visual inspection indicates that the embankment is in poor condition and the spillway structures of Lakeside Dam are currently in poor condition.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Small" size dam and "Significant" hazard classification is the One Hundred Year Flood to one-half the Probable Maximum Flood (PMF). Based on the hazard potential damage center located 2,000 feet downstream of the dam, where an oil distributor has pipes from storage tanks crossing the creek at the top of the bank level and a house is built in the floodplain, the one-half PMF event has been selected as the spillway design flood.

Hydrologic and hydraulic computations presented in Appendix D indicate that the spillway structure is not capable of discharging one-half the PMF without overtopping the embankment. The structure is considered to have an "Inadequate" spillway as it will not pass the spillway design flood without overtopping the embankment.

b. Adequacy of Information. The combined visual inspection and simplified calculations presented in Appendix D were adequate to indicate that further investigations are required for this structure.

c. Urgency. It is recommended that the measures presented in Section 7.2 be implemented as specified.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be taken immediately. Items (1) through (3) should be performed under the supervision of a registered professional engineer experienced in the design and construction of dams.

(1) A hydrologic/hydraulic study should be made to determine the best method of increasing the spillway capacity to meet current hydrologic/hydraulic criteria.

(2) A study should be made to determine the structural integrity of the left spillway timber flume and the timber spillway.

(3) Seepage through the dam should be monitored for increase in volume and for development of turbidity.

(4) All brush growing on the downstream slope should be removed.

b. Operation and Maintenance Procedures. Because of the potential for property damage and loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented for this facility. An operation and maintenance procedure, including a checklist of items to be inspected regularly, should be formalized and implemented to insure that all items are inspected on a regular basis and the embankment and appurtenances are maintained in the best possible condition.

APPENDIX

A

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Lakeside Dam* County *Schuylkill* State *Pennsylvania* National ID # *PA 00742*

Type of Dam *Timber crib and earth* Hazard Category *Significant*

Date(s) Inspection *5/6/80* Weather *Sunny, rainy* Temperature *70's*

Pool Elevation at Time of Inspection *1071* M.S.L. Tailwater at Time of Inspection *1062.9* M.S.L.
(taken from USGS map)

Inspection Personnel:

Mary F. Beck (Hydrologist) *Vincent McKeever (Hydrologist)*

Raymond S. Lambert (Geologist) *John H. Frederick, Jr. (Geotechnical)* *(5/15/80)*

Richard E. Mabry (Geotechnical/ Civil)

Mary F. Beck Recorder

Remarks:

Mr. Edmund McGrath, the owner, was on site and provide assistance to the inspection team.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

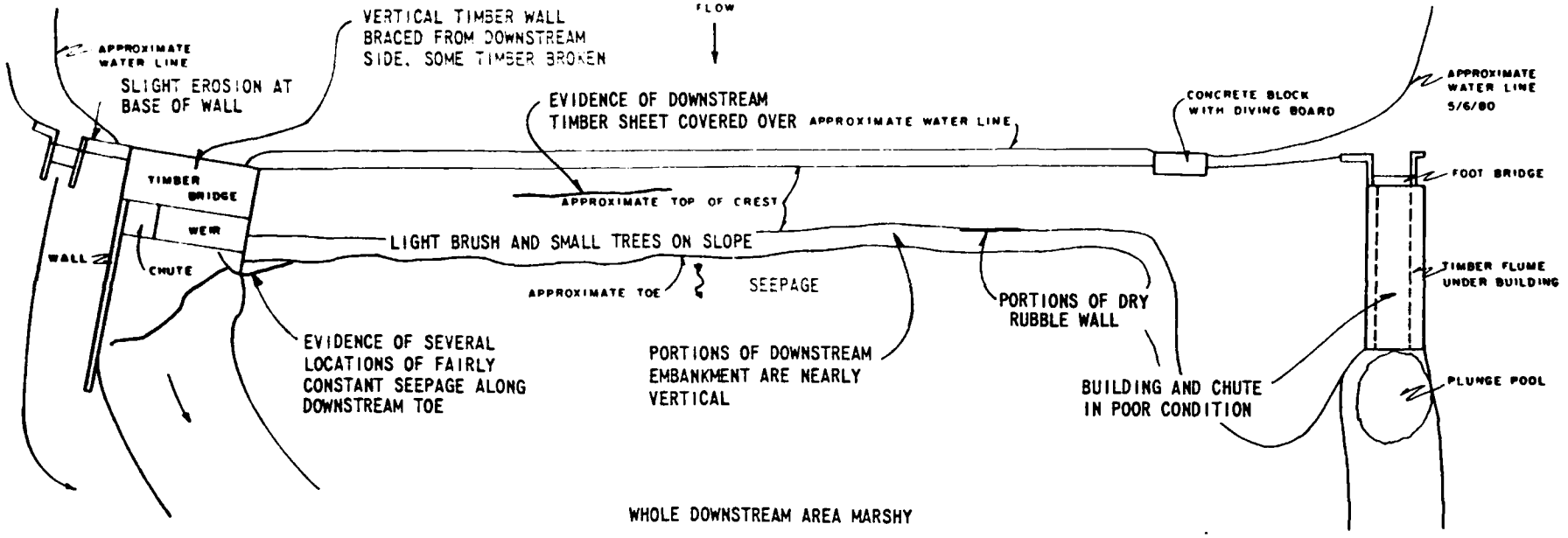
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*Localized scour around spillway entrances.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*See Plate 3, Appendix E.*	
RIPRAP FAILURES	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*Junctions of embankment and abutments generally appear to be in good condition.*	
ANY NOTICEABLE SEEPAGE	*Yes, water was flowing from the toe at a point midway between the abutments. Four other locations indicate frequent seepage.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*None*	



FIELD OBSERVATION PLAN
LAKESIDE DAM

SHEET 5A OF 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*N/A, constructed of timber.*	
INTAKE STRUCTURE	*Discharge through a wooden chute and over the downstream lip is controlled by wooden wall with stop logs at upstream edge. At the time of inspection, stop logs were removed to lower the reservoir.*	
OUTLET STRUCTURE	*N/A*	
OUTLET CHANNEL	*Discharges onto concrete paving in natural stream channel.*	
EMERGENCY GATE	*None, reservoir would be lowered by removing stop logs at upstream end.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*RIGHT SPILLWAY*	*LEFT SPILLWAY*
	Concrete channel 8 feet wide	*Concrete head wall and wing walls with flashboards.*
APPROACH CHANNEL	*None*	*None*
DISCHARGE CHANNEL	*Grassed swale conveys discharge about 100 feet downstream and empties into downstream channel.*	*Wooden chute under building, discharges into plunge pool, see Photograph No. 6.*
BRIDGE AND PIERS	*Foot bridge over channel, no piers.*	*Building collapsing.*

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*N/A*	
APPROACH CHANNEL	*N/A*	
DISCHARGE CHANNEL	*N/A*	
BRIDGE AND PIERS	*N/A*	
GATES AND OPERATION EQUIPMENT	*N/A*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Flat to moderate, but with occasional moderate to steep areas on right side of reservoir. Slopes are vegetated with trees, grass, and brush to water's edge. Sand bathing beach at left abutment of dam.*	
SEDIMENTATION	*Considerable amount of sediment is at upper end of reservoir.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*Channel is in generally good condition, with no debris or other obstruction accumulation. Banks are generally wooded, and with no excessive undercutting.*	
SLOPES	*The valley gradient is about 0.013.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*About 2,000 feet downstream of the dam is the first significant damage center which consists of a fuel oil distribution center. Pipes from the storage tanks cross the stream. Immediately downstream is a house. About 1,500 feet further downstream are several houses that have garages and other outbuildings built adjacent to the stream and are subject to damage in the event of large flows or failure.*	

APPENDIX

B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Lakeside Dam*

ID # *PA 00742*

ITEM	REMARKS
AS-BUILT DRAWINGS	*None Available*
REGIONAL VICINITY MAP	*See Plate 1, Appendix E*
CONSTRUCTION HISTORY	*See Text, Section 1.2, g*
TYPICAL SECTIONS OF DAM	*See Appendix E*
OUTLETS - PLAN	*See Appendix E*
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	*See Appendix D*
RAINFALL/RESERVOIR RECORDS	*None*

ITEM	REMARKS
DESIGN REPORTS	*None*
GEOLOGY REPORTS	*See Appendix F*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*None, except evaluation estimates made by State in 1975.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*None known*
POST-CONSTRUCTION SURVEYS OF DAM	*Unknown*
BORROW SOURCES	*Unknown*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*Yes, see Text*
HIGH POOL RECORDS	*None known, newspaper accounts of overtopping in 1972, and DER file mentions of previous overtopping.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*Brief review of dam - Robert F. Miller Associates, Inc. January 11 and July 31, 1972, also see Sheet 4 of 4, under Miscellaneous.*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None known*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E*
OPERATING EQUIPMENT PLANS & DETAILS	*None*

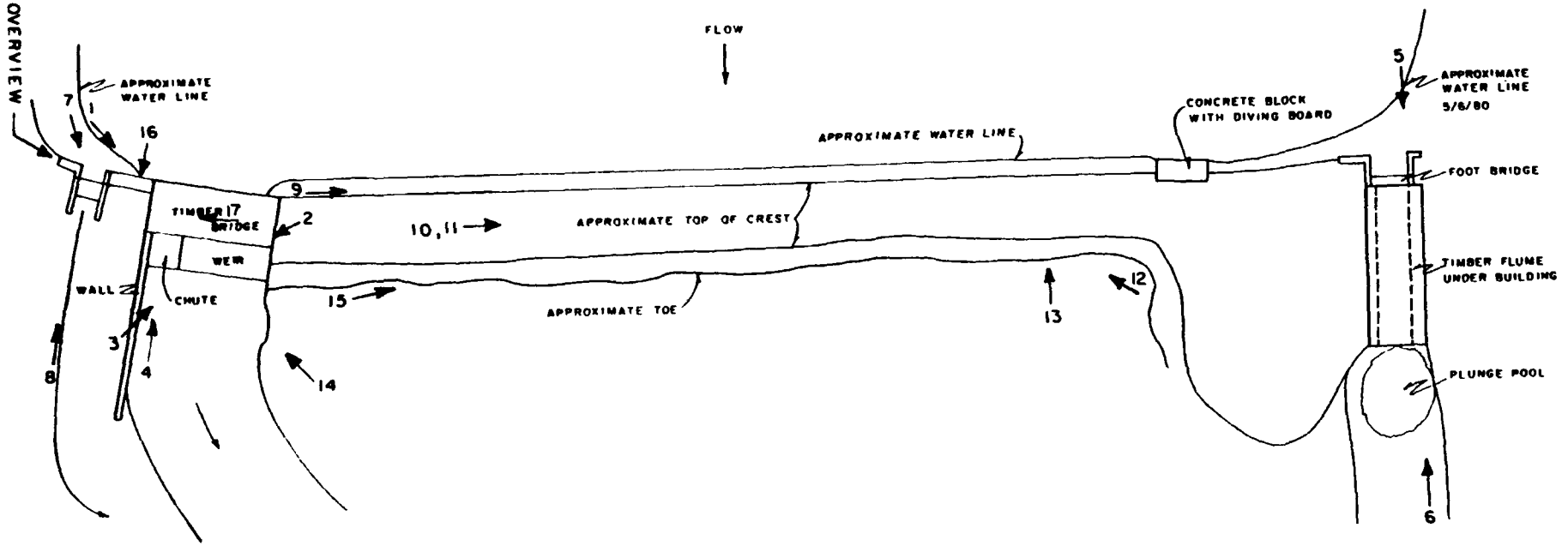
MISCELLANEOUS:

All information available in DER files

1. *"Report upon the Upper Dam of the Lakeside Ice and Improvement Company", April 12, 1915.*
2. *State inspection reports 1918 through 1973, with 22 black-and-white and eight color photographs.*
3. *Drawings of new spillway and dam reconstruction, 1933. (This work was not performed.)*
4. *Applications and permits to draw down level of lake - 1932 through 1974.*
5. *Correspondence between state and owner and internal memoranda.*
6. *Newspaper clippings.*

APPENDIX

C

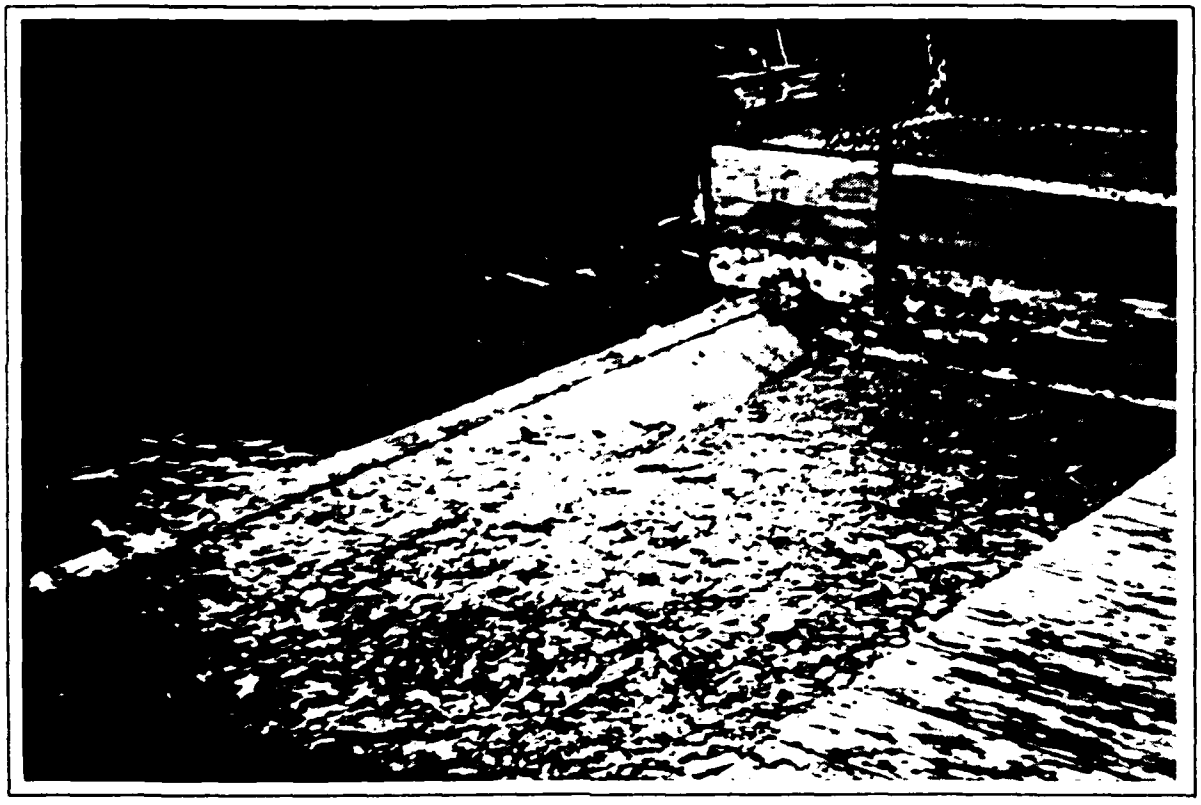


PHOTOGRAPH LOCATION PLAN
LAKESIDE DAM

PLATE C-1

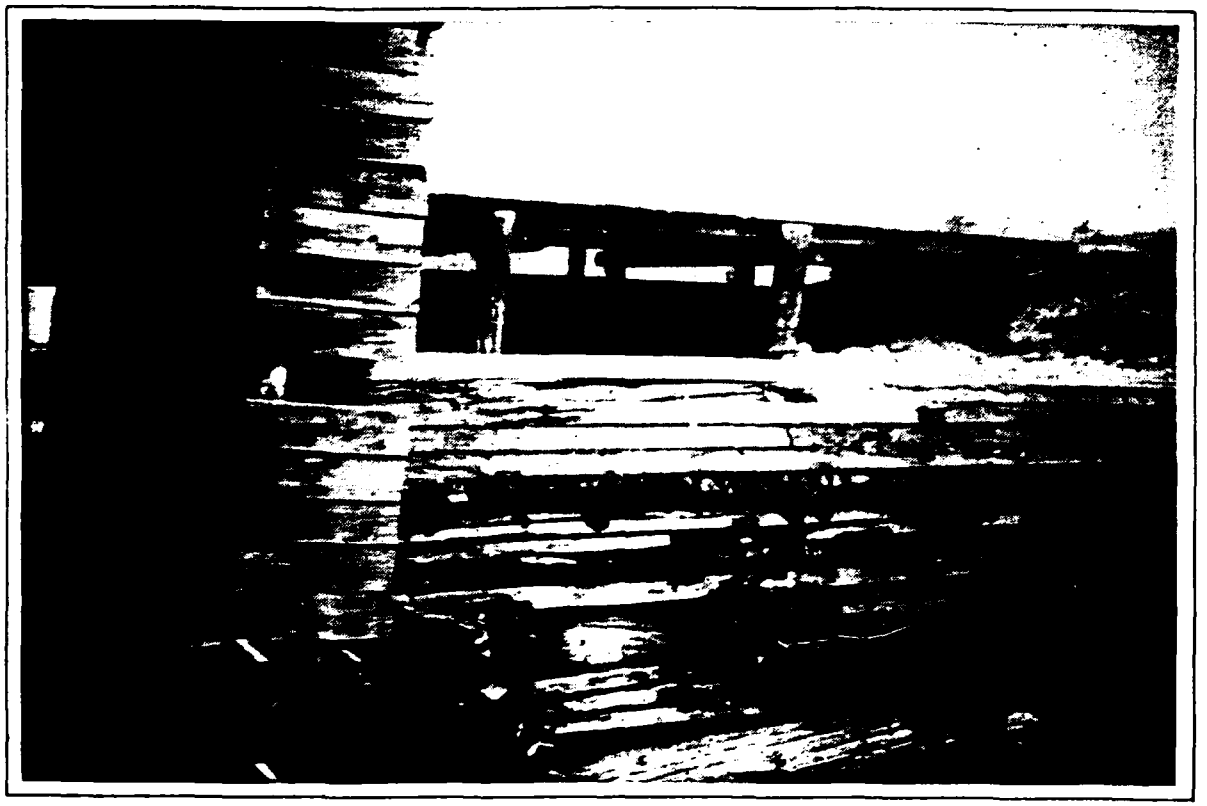
UPSTREAM SIDE OF TIMBER SPILLWAY.

PHOTOGRAPH NO. 1



TOP OF TIMBER SPILLWAY.

PHOTOGRAPH NO. 2

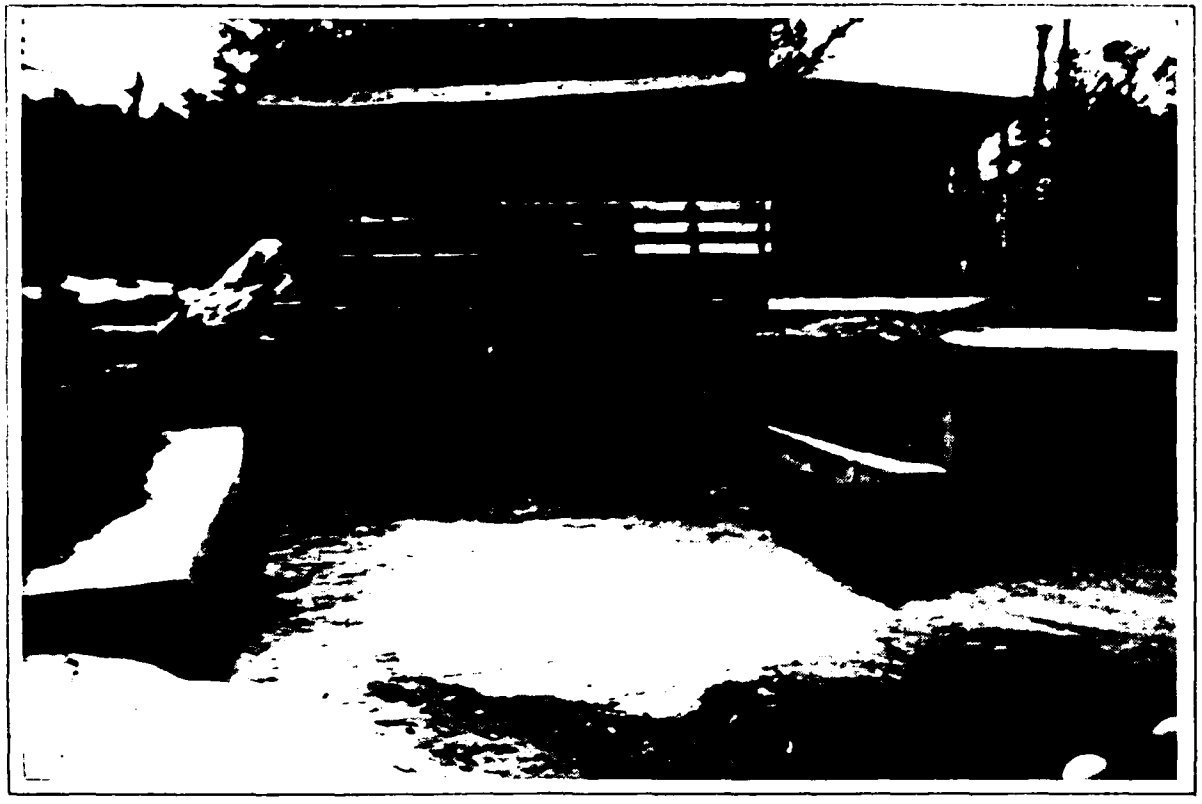


DOWNSTREAM SIDE OF TIMBER SPILLWAY.

PHOTOGRAPH NO. 3

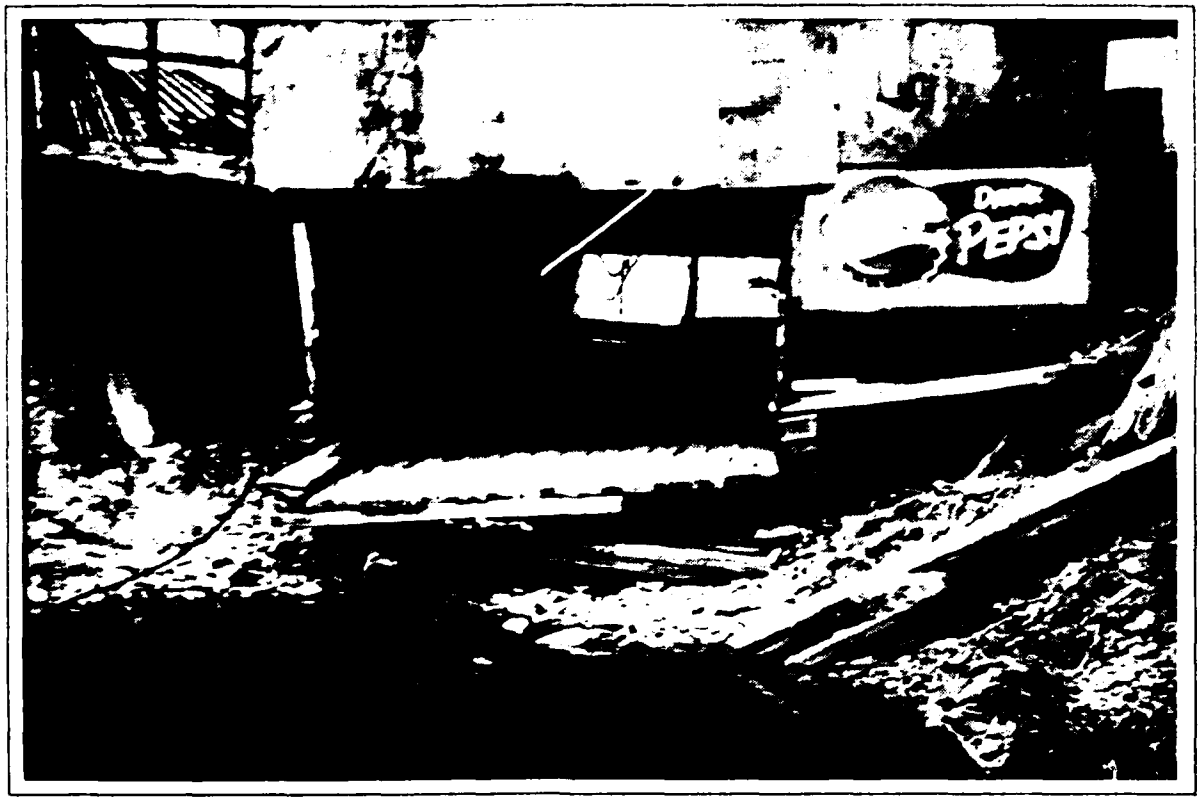
RIGHT DOWNSTREAM SIDE OF
TIMBER SPILLWAY.

PHOTOGRAPH NO. 4



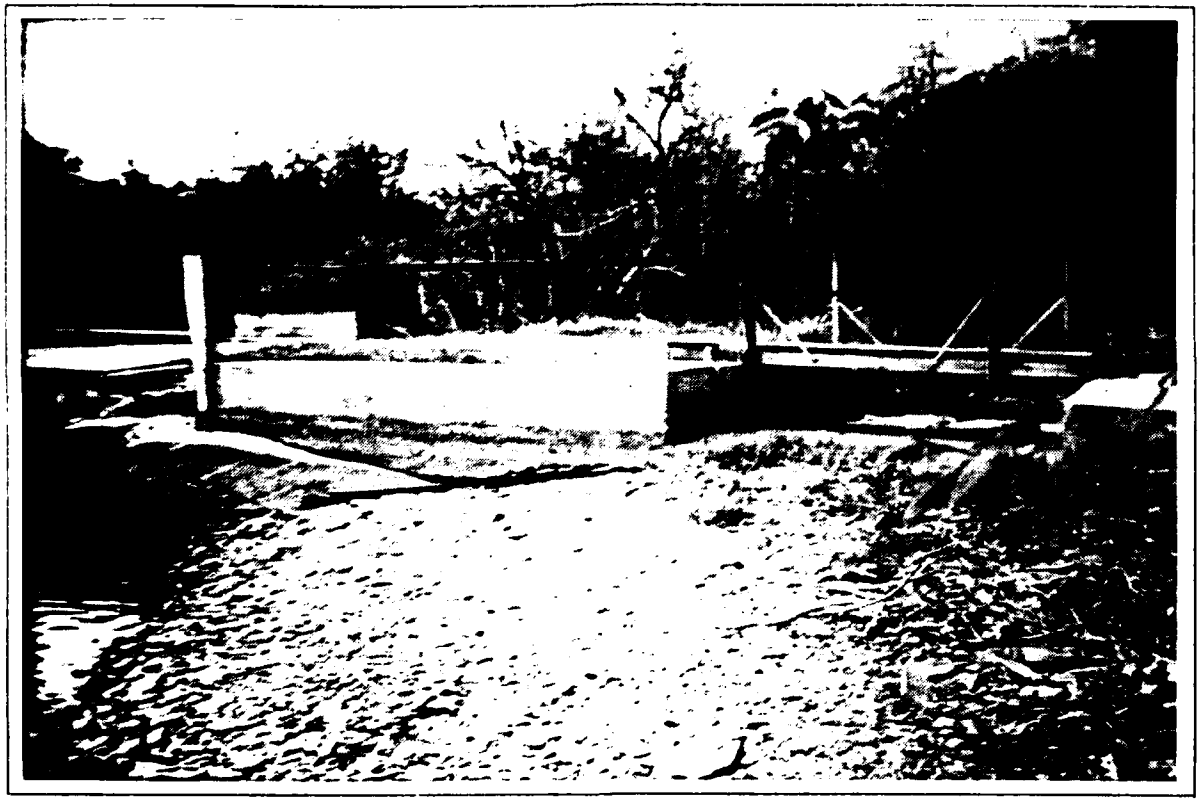
UPSTREAM END OF SPILLWAY.

PHOTOGRAPH NO. 5



DOWNSTREAM END OF LEFT SPILLWAY.

PHOTOGRAPH NO. 6



FOOTBRIDGE IN FOREGROUND CROSSES RIGHT SPILLWAY.

PHOTOGRAPH NO. 7

LOOKING UPSTREAM ALONG RIGHT SPILLWAY CHANNEL.

PHOTOGRAPH NO. 8

OVERVIEW OF UPSTREAM SLOPE.

PHOTOGRAPH NO. 9

OVERVIEW OF CREST. FIELD BOOK AT
PREVIOUS DOWNSTREAM EDGE.

PHOTOGRAPH NO. 10

CLOSE-UP OF PREVIOUS DOWNSTREAM
EDGE.

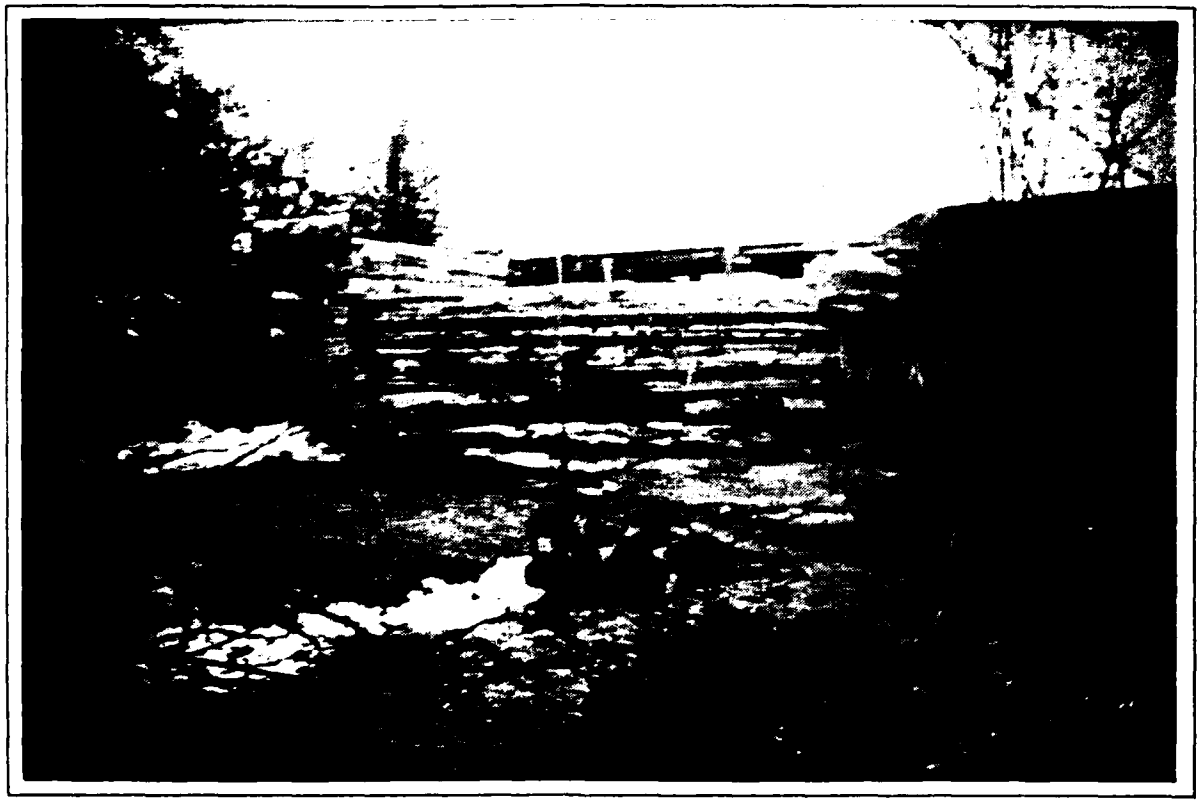
PHOTOGRAPH NO. 11

OVERVIEW OF DOWNSTREAM SLOPE.

PHOTOGRAPH NO. 12

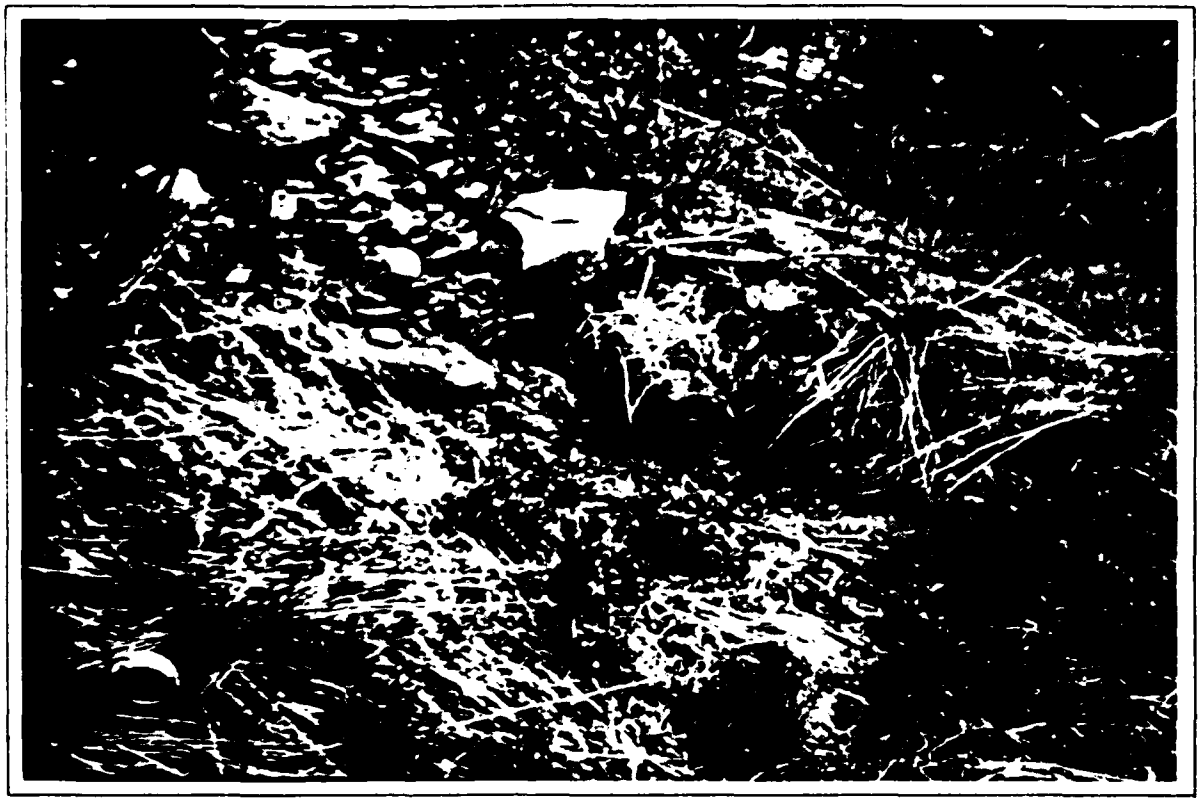
PORTIONS OF DOWNSTREAM EMBANKMENT
ARE A VERTICAL MASONRY WALL.

PHOTOGRAPH NO. 13



DOWNSTREAM CHANNEL IMMEDIATELY BELOW DAM.

PHOTOGRAPH NO. 14



SEEPAGE EXITING EMBANKMENT.

PHOTOGRAPH NO. 15

UNDERMINING OF THE SPILLWAY WALL AT
RIGHT END OF DAM.

PHOTOGRAPH NO. 16

BRACING OF UPSTREAM WALL OF TIMBER SPILLWAY.

PHOTOGRAPH NO. 17

SPILLWAY OF FIRST UPSTREAM DAM.

PHOTOGRAPH NO. 18

UPSTREAM FLOOD CONTROL DAM.

PHOTOGRAPH NO. 19

OIL DISTRIBUTOR AT DOWNSTREAM DAMAGE CENTER. PIPES FROM TANKS CROSS STREAM AT TOP OF BANK LEVEL.

PHOTOGRAPH NO. 20

APPENDIX

D

LAKESIDE DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *About 50% wooded, 25% residential development.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *1072.4 (60 Acre-Feet).*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *1074.5 (91 Acre-Feet).*

ELEVATION MAXIMUM DESIGN POOL: ---

ELEVATION TOP DAM: *1074.6 feet, top of bridge over spillway; 1074.3 feet is minimum embankment elevation, 1074.5 feet is minimum elevation at right abutment.*

SPILLWAYS	*LEFT SPILLWAY*	*RIGHT SPILLWAY*
a. Elevation	*1072.4, 1072.8*	*1073.3*
b. Type	*Wooden flume with flashboards*	*concrete & grassed channel*
c. Width	*10± feet*	*8 feet*
d. Length	*50 feet under building*	*100 feet*
e. Location Spillover	*Near left abutment*	*Right abutment*
f. Number and Type of Gates	*None*	

TIMBER SPILLWAY

a. Type *Timber crib spillway with upstream vertical timber wall, see plates, photographs.*

b. Location *Near right abutment.*

c. Entrance inverts *1073.3 feet.*

d. Exit inverts ---

e. Emergency draindown facilities *Stop-logs in timber spillway.*

HYDROMETEOROLOGICAL GAGES:

a. Type *None within watershed.*

b. Location *N/A*

c. Records *N/A*

MAXIMUM NON-DAMAGING DISCHARGE: *Not determined.*

DRAINAGE AREA:(1) *5.33 square miles.*

PROBABLE MAXIMUM PRECIPITATION (PMP)
FOR 10 SQ. MILES IN 24 HOURS:(2) *22.5 inches.*

ADJUSTMENT FACTORS FOR DRAINAGE AREA (%):(3)

Zone	*6*
6 Hours	*113*
12 Hours	*123*
24 Hours	*132*
48 Hours	*143*

SNYDER HYDROGRAPH PARAMETERS:(4)

	HOSENSOCK DAM	*LAKEWOOD DAM*	*LAKESIDE DAM*
Zone	*6*	*6*	*6*
Area	*2.1 sq. miles*	*0.8 sq. mile*	*2.43*
C_p, C_t	*0.40, 1.35*	*0.40, 1.35*	*0.40, 1.35*
L(5)	*3.28 miles*	*1.80 mile*	*3.12 miles*
Lca (6)	*1.52 miles*	*0.43 mile*	*1.37 miles*
$tp=C_t\ (L \cdot Lca)^{0.3}$	*2.18*	*1.25*	*2.09*

SPILLWAY CAPACITY AT MAXIMUM
WATER LEVEL(7) *231 cfs.*

---

(1) Measured from USGS maps.
(2) Hydrometerological Report No. 33, Figure 1.
(3) Hydrometerological Report No. 33, Figure 2.
(4) Information received from Corps of Engineers, Baltimore District.
(5) Length of longest water course from outlet to basin divide, measured from USGS maps.
(6) Length of water course from outlet to point opposite the centroid of drainage area, (see Plate 1, Appendix E) measured from USGS maps.
(7) See Sheet *13* of this Appendix.
Phase I Inspection Reports
Hosensock Dam (NDI No. PA 00627, DER No. 54-168, SCS PA 424)
Berger, July 1979
Lakewood Dam (DER No. 54-62) Ackenheil,
September 1980 (to be inspected)

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

BY MFB DATE 6/5/80 SUBJECT Lakeside Dam SHEET 4 OF 13
CHKD. BY RGM DATE 6/10/80 Hydrology / Hydraulics JOB No.

Classification (Ref. Recommended Guidelines for Safety Inspection of Dams).

1. The hazard potential is "Significant" as there would be appreciable economic loss and possible loss of life in the event of failure.

2. The size classification is "Small" based on its less than ___ ft height and estimated 91 Ac-Ft total storage capacity.

3. The selected spillway design flood, based on size and hazard classification, is 0.5 PMF (Probable Maximum Flood).

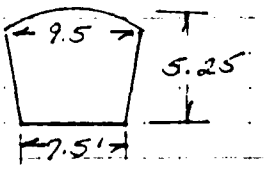
Hydrology and Hydraulic Analysis

1. Original Data - There is no original design for this dam. There is no subsequent evaluation of spillway capacity.

2. Evaluation Data

Inflow hydrograph parameters are shown on sheet 2. The total inflow hydrograph to Lakeside reservoir is composed of several parts.

A. The drainage area contributing to Hasensock Dam, SCS PA 424. Outflow from that flood control dam combines with:
B. The runoff from Lakewood Dam watershed.
C. The out flow from Lakewood Dam flows under a railroad embankment on the order of 30 ft high.



D. The watershed along Pine Creek contributes to Lakeside Dam.

E. Flow thru culvert combines with Pine Creek discharge.

BY MEB DATE 6/5/80 SUBJECT Lakeside Dam Hydrology / Hydraulics SHEET 5 OF 13

CHKD. BY RCM DATE 6/10/80 JOB No.

Outflow hydrograph

A. Discharge and storage data for Hosensock Dam, shown on sheet 8, was obtained from Phase I Inspection Report, July 1979.

B. Discharge from Lakewood Dam was estimated by (see sheet 9)

$Q = C L H^{3/2}$

L = 65 ft field check

C = 2.6 Ref. King & Brater Handbook (Tab. 5-3) of Hydraulics, 2nd ed.

Areas for volume measured from USGS map.

C. As an approximation of the effects of the railroad culvert, Lakewood outflow was routed under the embankment assuming 5.25 ft high, 8.5 ft wide culvert, invert at 271, under inlet control, ref Hydraulic Charts for Highway Culverts, Hydraulic Engineering Circular No. 5, Fed. Highway Adm.

D. Discharge Data for Lakeside Dam, sheet 10

The hydraulic characteristics of the spillways are complicated and the discharge can only be approximated by the following calculations.

$Q = C L H^{3/2}$

Water Surface	Left Spillway: left side C = 3.1, L = 4.2 ft, crest 1072.8		Left Spillway: right side C = 3.1, L = 5.6 ft, crest 1072.4		Timber Spillway* C = 3.1, L = 30 ft (measured) crest 1073.3		Right Spillway C = 2.6, L = 8 ft, crest 1073.4		Total Discharge
	H	Q	H	Q	H	Q	H	Q	Q
1072.4	-	-	0	0	-	-	-	-	0
1072.9	0	0	0.5	6	-	-	-	-	6
1073.3	0.5	4.6	0.9	15.3	0	0	-	-	20
1074.3	1.5	23.9	1.9	47.1	1.0	93.0	0.9	17.7	181
1074.8	2.0	36.8	2.4	66.8	1.5	170.8	1.4	34.4	309
	assume spillway does not increase significantly with increasing head								
1076.									325

* Assumes upstream timber wall w/ stop-logs controls discharge

Elevation - Storage Data, sheet 10
Areas were measured from USGS map and the computer program calculated capacity.

3. Spillway Adequacy - as the spillways cannot pass the spillway design storm without overtopping the embankment, the spillway classification is "Inadequate".

Estimate of velocity at DS2 during 0.5 PMF.
Q = 4212 cfs (sheet 12)
Reach Length = 1750 ft. } sheet 11
Storage ≈ 26.6 Ac-Ft }

$$\text{cross section area} = \frac{26.6 \text{ Ac-Ft}}{1750 \text{ ft}} \frac{43560 \text{ ft}^2}{\text{Ac}}$$

$$= 662 \text{ ft}^2$$

$$v = Q/A = 4212/662$$

$$= 6.3 \text{ ft/sec}$$

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT          IHO
ROUTE HYDROGRAPH TO           OHO
RUNOFF HYDROGRAPH AT          ILW
COMBINE  2 HYDROGRAPHS AT     ILW
ROUTE HYDROGRAPH TO           OLW
ROUTE HYDROGRAPH TO           CUL
RUNOFF HYDROGRAPH AT          ILS
COMBINE  2 HYDROGRAPHS AT     COM
ROUTE HYDROGRAPH TO           OLS
ROUTE HYDROGRAPH TO           DS1
ROUTE HYDROGRAPH TO           DS2
END OF NETWORK
```

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  26 FEB 79
**************************************

RUN  DATE* 80/06/08.
     TIME* 06.06.03.
```

LAKESIDE DAM
NAT ID NO. PA00742 DER IN 54-60
OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
200	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS=   .10   .20   .30   .40   .50

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO HOSENSUCK DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
IHO	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.10	0.00	5.33	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.50	113.00	123.00	132.00	143.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 2.18   CP= .40   NTA= 0

RECESSION DATA
STRTQ=   -1.50   QRCSN=   -.05   RTIOR= 2.00

UNIT HYDROGRAPH 92 END-OF-PERIOD ORDINATES, LAG=   2.20 HOURS, CP= .40 VOL= 1.00

8.	32.	65.	105.	148.	189.	221.	243.	252.	245.
231.	217.	204.	192.	181.	170.	160.	151.	142.	134.
126.	118.	111.	105.	98.	93.	87.	82.	77.	73.
68.	64.	61.	57.	54.	50.	47.	45.	42.	40.
37.	35.	33.	31.	29.	27.	26.	24.	23.	22.
20.	19.	18.	17.	16.	15.	14.	13.	12.	12.
11.	10.	10.	9.	9.	8.	8.	7.	7.	6.
6.	6.	5.	5.	5.	4.	4.	4.	4.	3.
3.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	2.								

0
END-OF-PERIOD FLOW

```
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q       MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                       SUM  25.74   23.33    2.41    114039.
                                                                          ( 654.)( 593.)(   61.)( 3229.22)
```

HYDROGRAPH ROUTING

OUTFLOW HYDROGRAPH FOR ROSENSOCK DAM

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OHO	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1100.	-1

STAGE	1099.80	1103.00	1104.00	1111.00	1120.70	1122.00	1123.00	1124.00	1125.00	1126.00
FLOW	0.00	22.00	72.00	90.00	108.00	1000.00	1700.00	2700.00	3900.00	5400.00
CAPACITY=	0.	20.	399.	613.						
ELEVATION=	1091.	1100.	1121.	1126.						

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1099.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1126.0	0.0	0.0	0.

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO LAKEWOOD DAM

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
ILW	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.80	0.00	5.33	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.50	113.00	123.00	132.00	143.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRIL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.25 CP= .40 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 53 END-OF-PERIOD ORDINATES, LAG= 1.26 HOURS, CP= .40 VOL= 1.00

12.	46.	92.	135.	162.	163.	148.	133.	120.	107.
96.	87.	78.	70.	63.	56.	51.	45.	41.	37.
33.	30.	27.	24.	21.	19.	17.	16.	14.	13.
11.	10.	9.	8.	7.	7.	6.	5.	5.	4.
4.	3.	3.	3.	3.	2.	2.	2.	2.	1.
1.	1.	1.							

0 END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.74	23.33	2.41	47264.
										(654.3)	(593.1)	(61.3)	(1338.37)

HYDROGRAPH ROUTING

OUTFLOW HYDROGRAPH FOR LAKEWOOD DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OLW	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1081.	0

SURFACE AREA=	7.	27.
CAPACITY=	0.	306.
ELEVATION=	1081.	1100.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1081.0	65.0	2.6	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1083.8	2.5	1.5	500.

HYDROGRAPH ROUTING

FLOW THROUGH CULVERT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CUL	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1071.	-1

STAGE	1071.00	1073.60	1076.20	1081.50	1086.80	1092.00
FLOW	0.00	136.00	298.00	595.00	807.00	1105.00

SURFACE AREA=	3.	7.	9.
CAPACITY=	0.	43.	201.
ELEVATION=	1071.	1080.	1100.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1071.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1100.0	2.5	1.5	1000.

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH ALONG PINE CREEK

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
ILS	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.43	0.00	5.33	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.50	113.00	123.00	132.00	143.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.09 CP= .40 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 88 END-OF-PERIOD ORDINATES, LAG= 2.09 HOURS, CP= .40 VOL= 1.00

11.	40.	82.	132.	186.	236.	273.	298.	304.	292.
274.	257.	241.	226.	212.	199.	186.	175.	164.	154.
144.	135.	127.	119.	112.	105.	98.	92.	87.	81.
76.	71.	67.	63.	59.	55.	52.	49.	46.	43.
40.	38.	35.	33.	31.	29.	27.	26.	24.	23.
21.	20.	19.	17.	16.	15.	14.	14.	13.	12.
11.	10.	10.	9.	9.	8.	8.	7.	7.	6.
6.	6.	5.	5.	5.	4.	4.	4.	4.	3.
3.	3.	3.	3.	2.	2.	2.	2.		

0 END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 25.74 23.33 2.41 133514.
(654.)(593.)(61.)(3780.70)

HYDROGRAPH ROUTING

LAKESIDE OUTFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DLS	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPRP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1072.	-1

STAGE	1072.40	1072.90	1073.30	1074.30	1074.80	1076.00
FLOW	0.00	6.00	20.00	181.00	307.00	325.00
SURFACE AREA=	0.	13.	22.			
CAPACITY=	0.	42.	196.			
ELEVATION=	1061.	1071.	1080.			

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
1072.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1074.5	0.0	0.0	0.

CREST LENGTH	0.	160.	390.	430.
AT OR BELOW ELEVATION	1074.5	1075.0	1076.0	1077.0

HYDROGRAPH ROUTING

SECTION 300 FEET DOWNSTREAM OF DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0550	.0400	.0550	1061.0	1083.3	300.	.00200

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1082.30 60.00 1062.30 189.00 1062.20 195.00 1061.00 223.00 1061.00
243.00 1065.10 331.00 1064.50 351.00 1086.50

STORAGE	0.00	.27	1.60	3.08	4.69	6.84	9.17	11.53	13.93	16.36
	18.84	21.35	23.90	26.49	29.12	31.78	34.49	37.23	40.00	42.81
OUTFLOW	0.00	65.90	416.57	1105.28	2098.78	3475.04	5260.67	7390.58	9837.21	12582.77
	15614.02	18920.86	22495.28	26330.80	30422.12	34764.82	39355.24	44190.30	49267.44	54863.10
STAGE	1061.00	1062.17	1063.35	1064.52	1065.69	1066.87	1068.04	1069.22	1070.39	1071.56
	1072.74	1073.91	1075.08	1076.26	1077.43	1078.61	1079.78	1080.95	1082.13	1083.30
FLOW	0.00	65.90	416.57	1105.28	2098.78	3475.04	5260.67	7390.58	9837.21	12582.77
	15614.02	18920.86	22495.28	26330.80	30422.12	34764.82	39355.24	44190.30	49267.44	54863.10

HYDROGRAPH ROUTING

SECTION AT DOWNSTREAM OIL DISTRIBUTOR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0550	.0400	.0400	1040.0	1060.0	1750.	.00600

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1066.50 20.00 1046.50 50.00 1044.50 60.00 1040.00 78.00 1040.00
98.00 1044.50 340.00 1051.00 360.00 1061.00

STORAGE	0.00	.86	1.92	3.17	4.63	6.86	11.40	18.12	26.62	36.89
	48.93	62.49	76.35	90.35	104.48	118.74	133.14	147.67	162.34	177.13
OUTFLOW	0.00	58.67	195.41	404.75	689.82	1126.56	1840.95	2970.79	4585.62	6751.05
	9533.55	13281.62	17933.12	23206.23	29067.33	35490.19	42453.63	49940.14	57934.93	66425.39
STAGE	1040.00	1041.05	1042.11	1043.16	1044.21	1045.26	1046.32	1047.37	1048.42	1049.47
	1050.53	1051.58	1052.63	1053.68	1054.74	1055.79	1056.84	1057.89	1058.95	1060.00
FLOW	0.00	58.67	195.41	404.75	689.82	1126.56	1840.95	2970.79	4585.62	6751.05
	9533.55	13281.62	17933.12	23206.23	29067.33	35490.19	42453.63	49940.14	57934.93	66425.39

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 .50
HYDROGRAPH AT	IHO	2.10	1	375.	749.	1124.	1498.	1873.
	(	5.44)	(	10.61)(	21.21)(	31.82)(	42.43)(	53.04)(
ROUTED TO	OHO	2.10	1	85.	108.	697.	1188.	1627.
	(	5.44)	(	2.41)(	3.05)(	19.75)(	33.64)(	46.09)(
HYDROGRAPH AT	ILW	.80	1	198.	395.	593.	790.	988.
	(	2.07)	(	5.59)(	11.19)(	16.78)(	22.37)(	27.96)(
2 COMBINED	TLW	2.90	1	254.	472.	892.	1589.	2253.
	(	7.51)	(	7.19)(	13.38)(	25.25)(	44.99)(	63.78)(
ROUTED TO	OLW	2.90	1	246.	460.	889.	1591.	2248.
	(	7.51)	(	6.96)(	13.04)(	25.16)(	45.05)(	63.66)(
ROUTED TO	CUL	2.90	1	228.	411.	730.	1134.	2660.
	(	7.51)	(	6.47)(	11.63)(	20.67)(	32.11)(	75.32)(
HYDROGRAPH AT	ILS	2.43	1	445.	891.	1336.	1782.	2227.
	(	6.29)	(	12.62)(	25.23)(	37.85)(	50.46)(	63.08)(
2 COMBINED	CON	5.33	1	658.	1287.	1886.	2455.	4571.
	(	13.80)	(	18.64)(	36.45)(	53.40)(	69.53)(	129.45)(
ROUTED TO	OLS	5.33	1	655.	1284.	1885.	2456.	4188.
	(	13.80)	(	18.55)(	36.41)(	53.38)(	69.54)(	118.60)(
ROUTED TO	DS1	5.33	1	655.	1285.	1885.	2456.	4243.
	(	13.80)	(	18.55)(	36.38)(	53.38)(	69.54)(	120.14)(
ROUTED TO	DS2	5.33	1	655.	1285.	1883.	2455.	4212.
	(	13.80)	(	18.54)(	36.38)(	53.33)(	69.52)(	119.27)(

SUMMARY OF DAM SAFETY ANALYSIS

Hasensock Dam - flood control structure

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1099.80	1099.80	1126.00
STORAGE	20.	20.	613.
OUTFLOW	0.	0.	5400.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1109.07	0.00	188.	85.	0.00	49.50	0.00
.20	1120.50	0.00	395.	108.	0.00	50.00	0.00
.30	1121.56	0.00	434.	697.	0.00	45.00	0.00
.40	1122.27	0.00	462.	1188.	0.00	44.00	0.00
.50	1122.90	0.00	488.	1627.	0.00	43.50	0.00

SUMMARY OF DAM SAFETY ANALYSIS

Lakewood Dam

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	
ELEVATION	1081.00	1081.00	1083.80	
STORAGE	3.	0.	23.	Flood water
OUTFLOW	0.	0.	792.	storage, only

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1082.28	0.00	10.	246.	0.00	42.00	0.00
.20	1082.95	0.00	16.	460.	0.00	41.50	0.00
.30	1083.91	.11	24.	889.	1.50	45.00	0.00
.40	1084.37	.57	29.	1391.	6.50	43.75	0.00
.50	1084.69	.89	32.	2248.	8.00	43.25	0.00

SUMMARY OF DAM SAFETY ANALYSIS

Railroad embankment acts as dam

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1071.00	1071.00	1160.00
STORAGE	0.	0.	201.
OUTFLOW	0.	0.	1193.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1075.08	0.00	15.	228.	0.00	43.00	0.00
.20	1078.21	0.00	31.	411.	0.00	42.75	0.00
.30	1084.87	0.00	[illegible]	730.	0.00	46.50	0.00
.40	1097.99	0.00	183.	1134.	0.00	45.75	0.00
.50	1100.69	.69	207.	2660.	3.50	43.50	0.00

LAKESIDE DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	
ELEVATION	1072.40	1072.40	1074.50	Rt. Abutment
STORAGE	60.	60.	91.	Area
OUTFLOW	0.	0.	231.	

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1075.47	.97	107.	655.	9.25	42.75	0.00
.20	1076.00	1.50	117.	1286.	11.50	42.25	0.00
.30	1076.35	1.85	123.	1885.	12.25	42.25	0.00
.40	1076.62	2.12	128.	2456.	12.75	42.25	0.00
.50	1077.31	2.81	141.	4188.	13.50	43.75	0.00

PLAN 1 STATION DS1

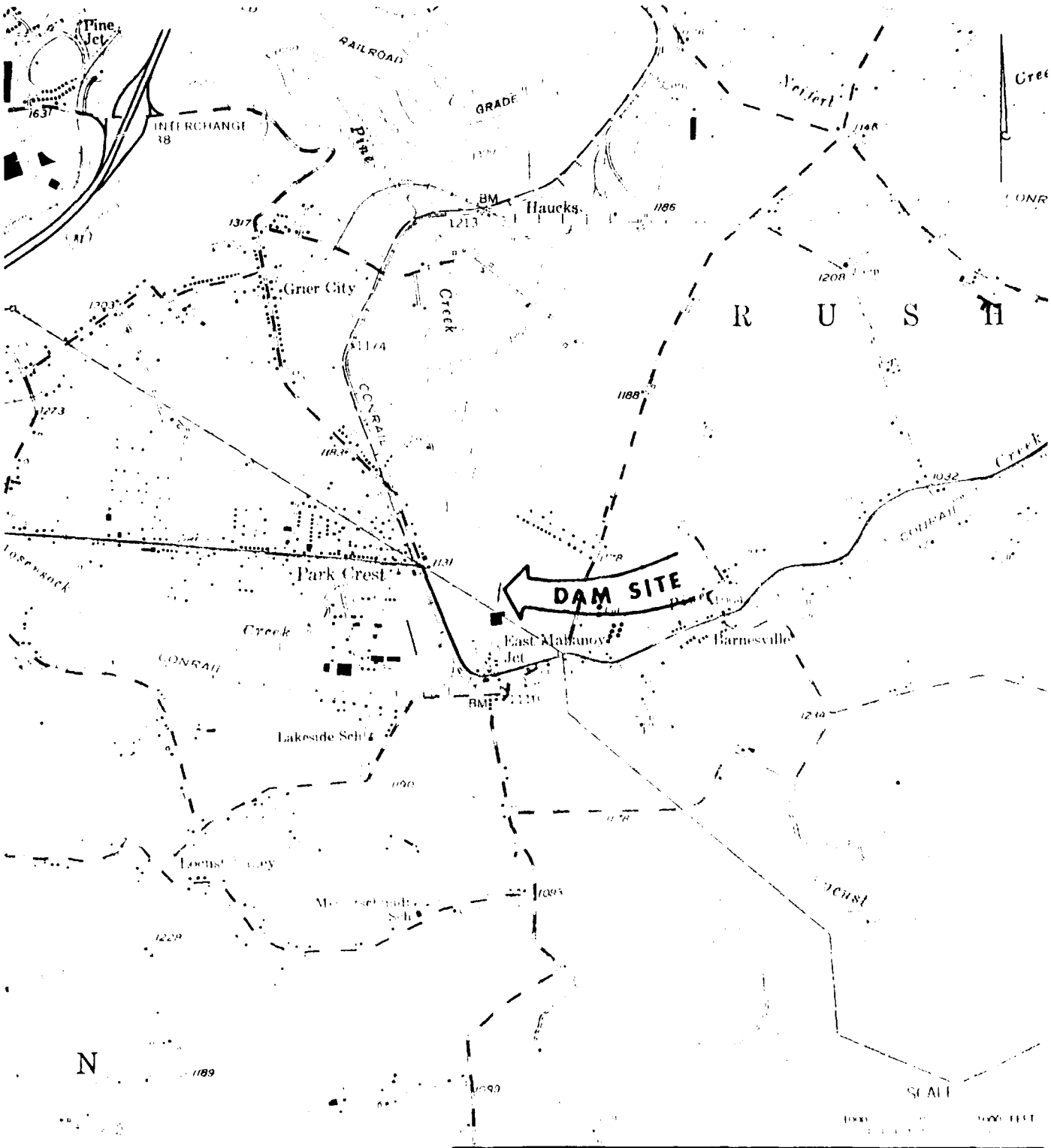
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	655.	1063.8	42.75
.20	1285.	1064.7	42.50
.30	1885.	1065.4	42.25
.40	2456.	1066.0	42.25
.50	4243.	1067.4	43.75

PLAN 1 STATION DS2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS	
.10	655.	1044.1	42.75	top of stream bank,
.20	1285.	1045.3	42.50	1044 St
.30	1883.	1046.4	42.25	
.40	2455.	1046.9	42.25	house about 1046 St
.50	4212.	1048.2	43.75	

APPENDIX

E



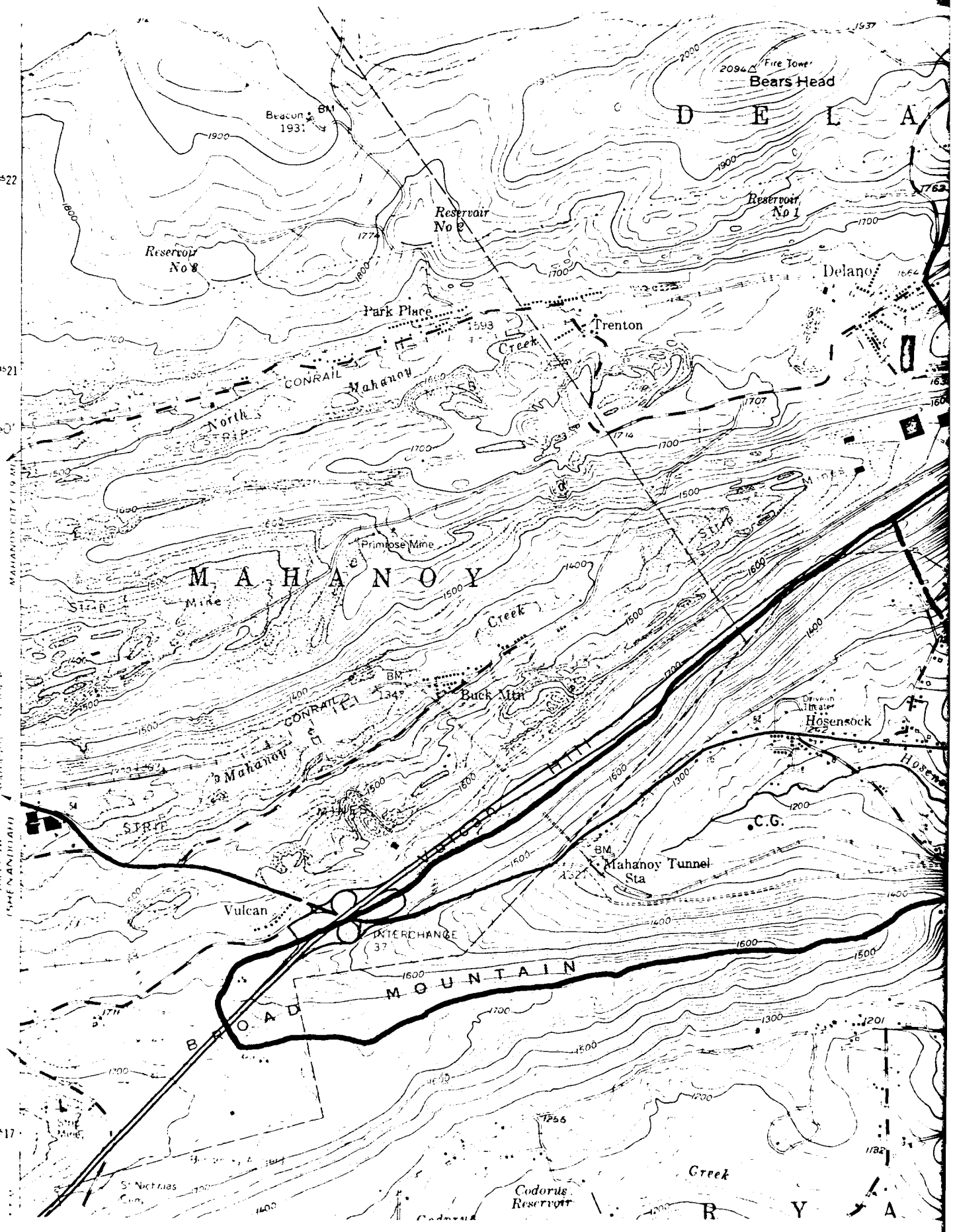
REGIONAL LOCATION PLAN

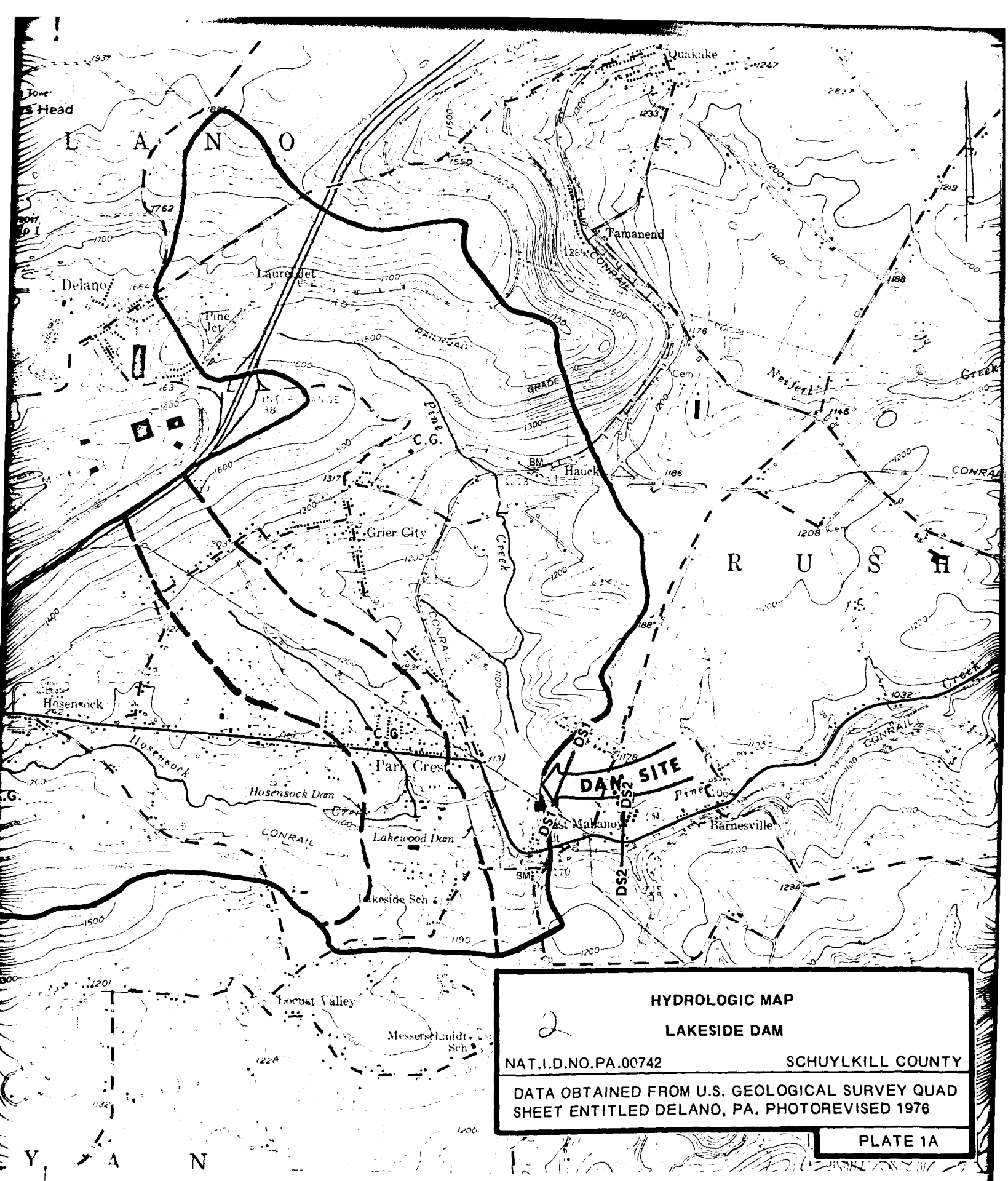
LAKESIDE DAM

NAT.I.D.NO.PA.00742 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY QUAD SHEET ENTITLED DELANO,PA. PHOTOREVISED 1976

PLATE 1


Bears Head
2094
Fire Tower
Beacon
1931
BM
Reservoir No 2
Reservoir No 1
Reservoir No 3
Delano
Park Place
Trenton
Creek
CONRAIL
Mahanoy
North
STRIP
Primrose Mine
MAHANOY
Mine
Creek
Buck Mtn
BM
1345
CONRAIL
Mahanoy
STRIP
MINES
Drive-in
Theater
Hosensock
C.G.
BM
1332
Mahanoy Tunnel
Sta
Vulcan
INTERCHANGE
37
MOUNTAIN
ROAD
St Nicholas
Codorus
Reservoir
Creek
MAHANOY CITY 1.9 MI
SHENANDOAH
45°22'
45°21'
50'
17'



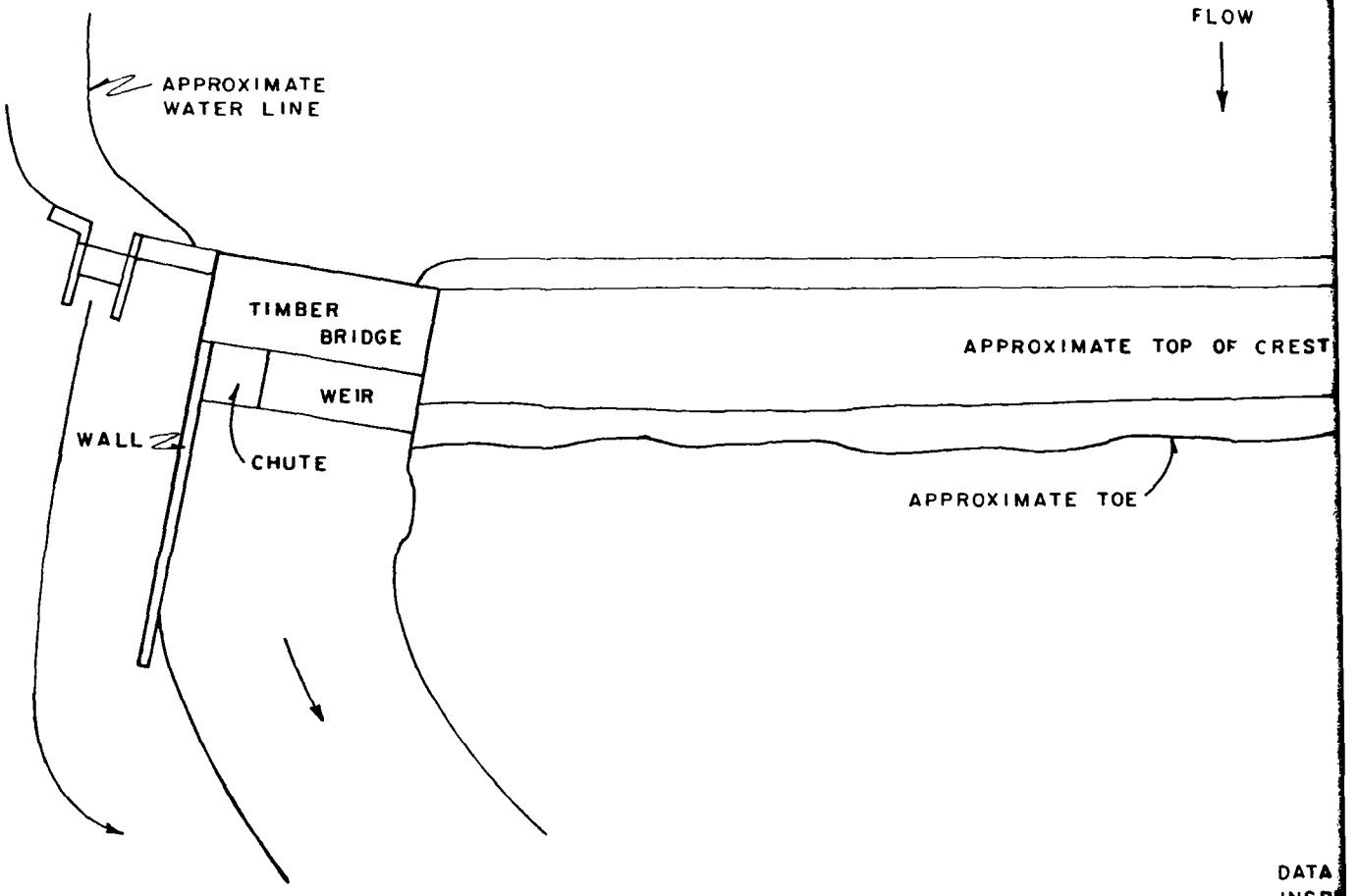
HYDROLOGIC MAP

LAKESIDE DAM

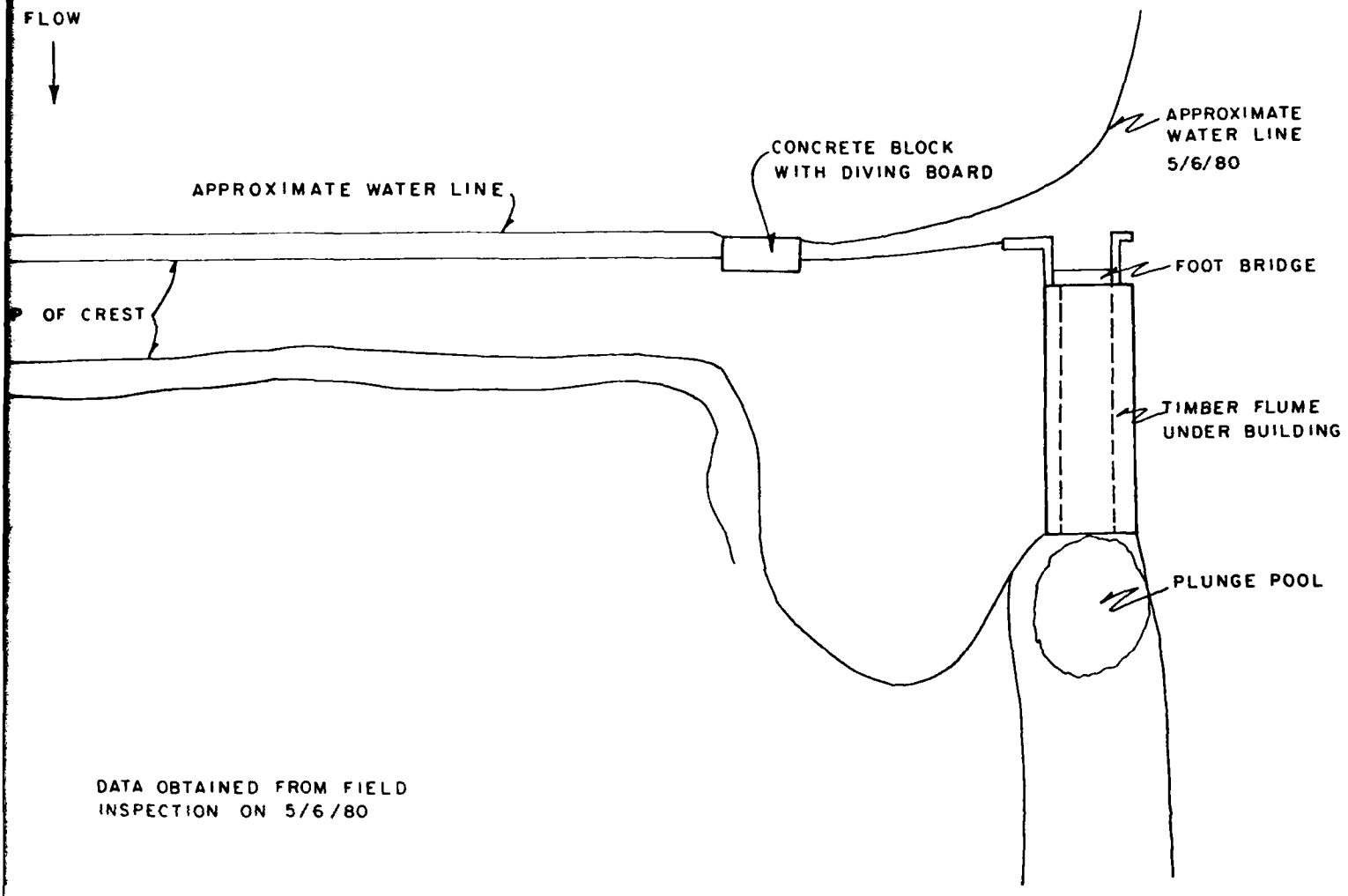
NAT.I.D.NO.PA.00742 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY QUAD SHEET ENTITLED DELANO, PA. PHOTOREVISED 1976

PLATE 1A


FLOW
APPROXIMATE
WATER LINE
TIMBER
BRIDGE
WEIR
WALL
CHUTE
APPROXIMATE TOP OF CREST
APPROXIMATE TOE

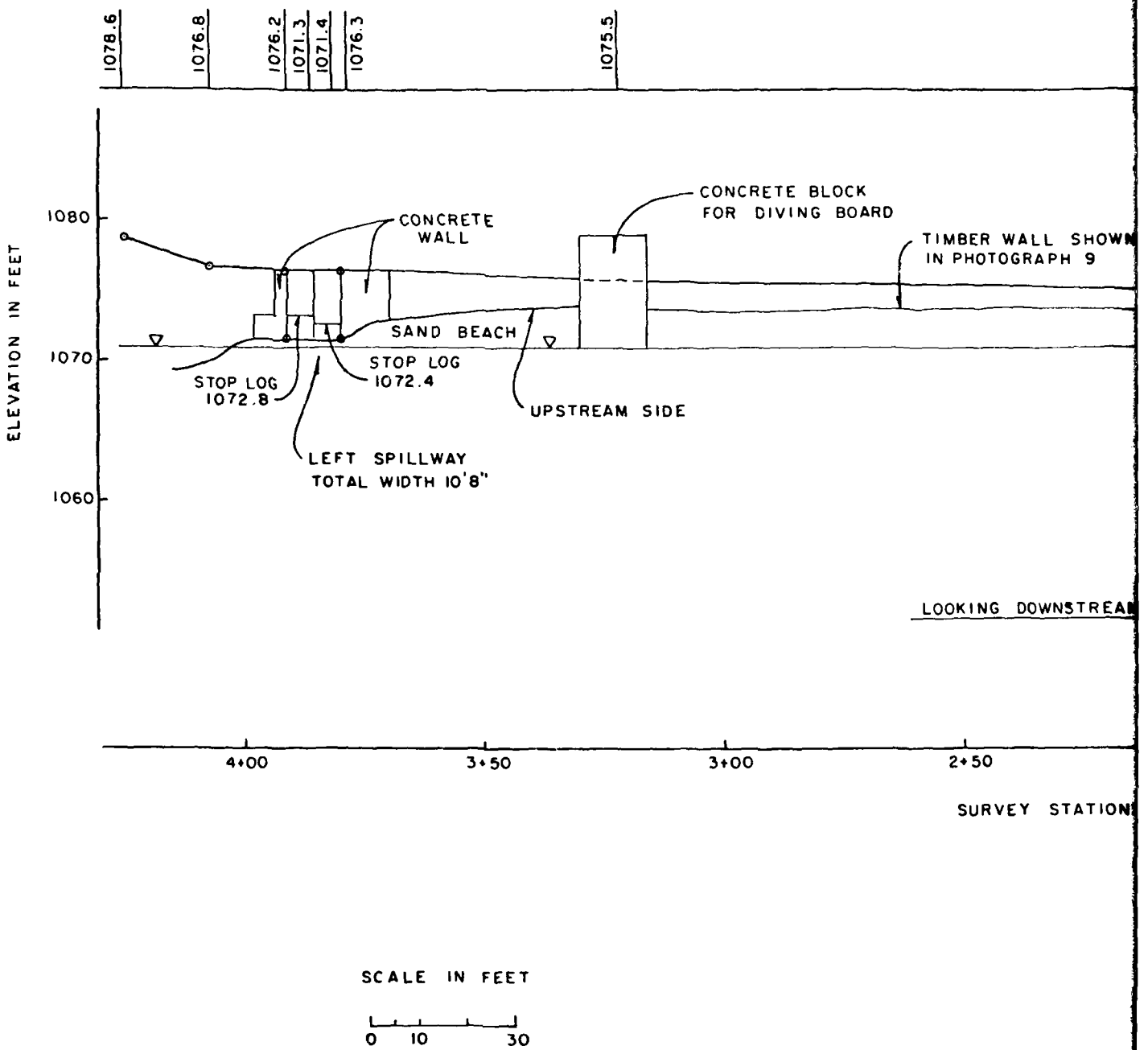
DATA
INSP



DATA OBTAINED FROM FIELD INSPECTION ON 5/6/80

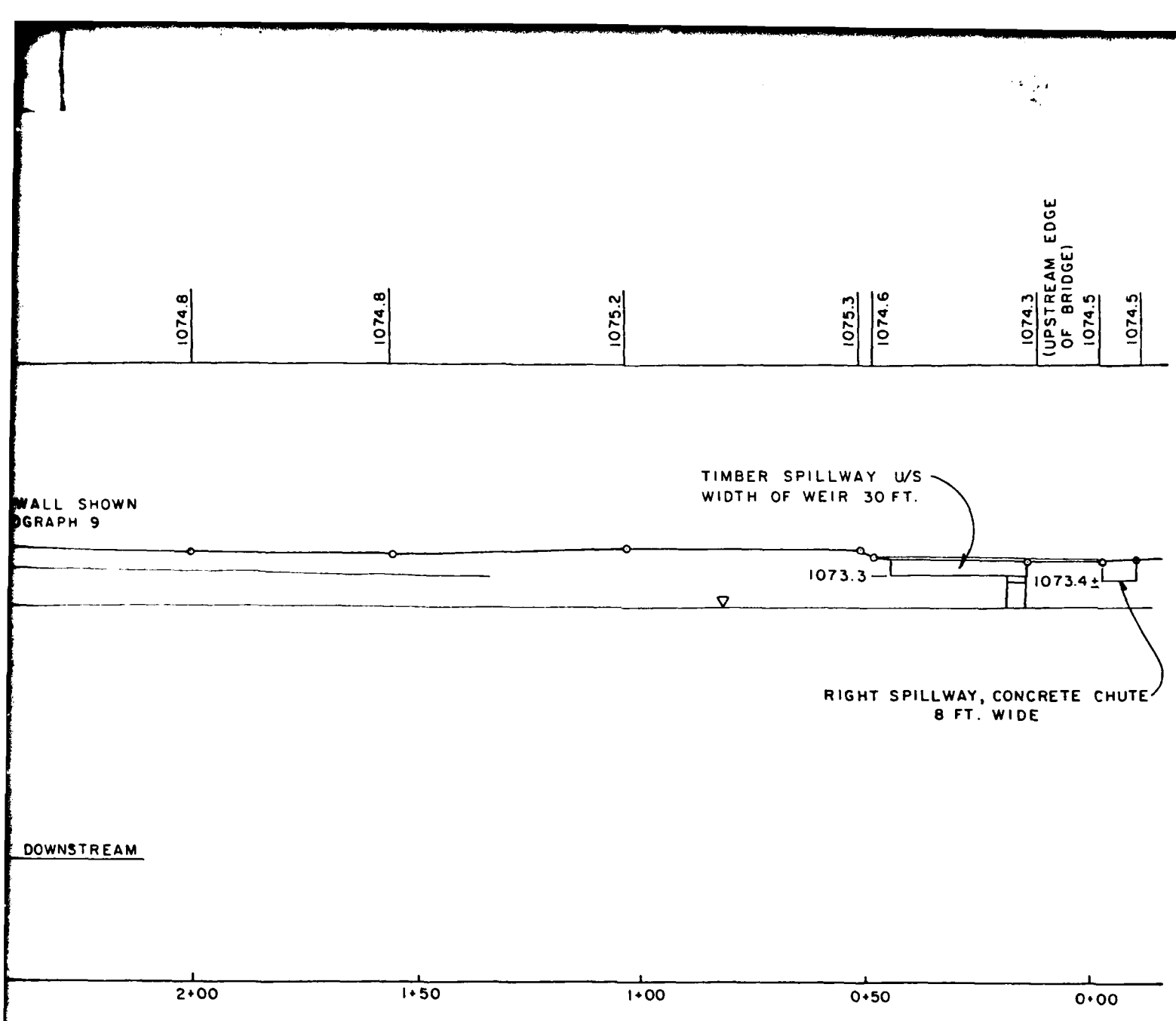
PLAN
LAKESIDE DAM

PLATE 2



SCALE IN FEET

0 10 30

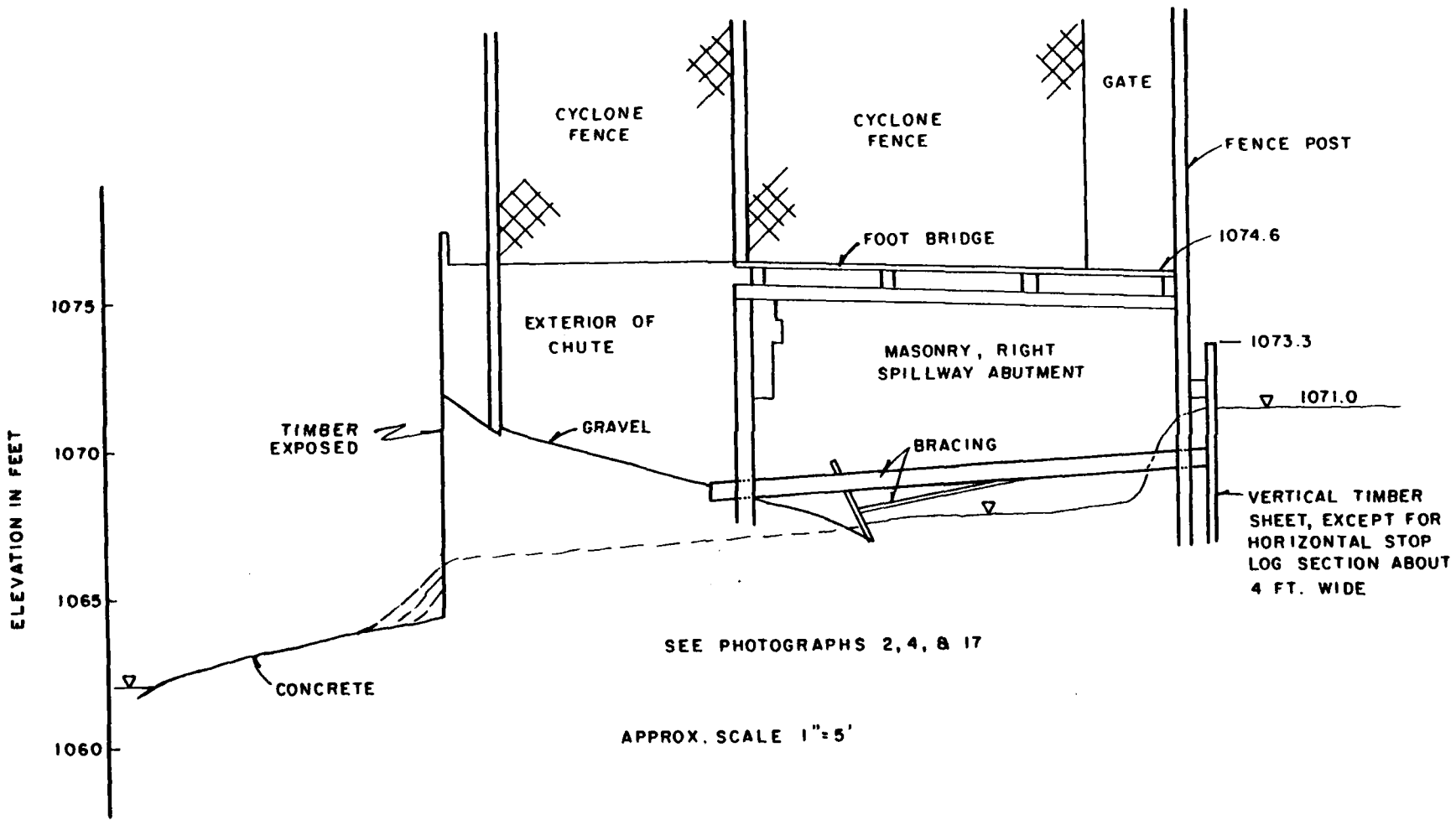


NOTE: WATER LEVEL 1071 TAKEN FROM USGS MAP.

FIELD OBSERVATION PROFILE
LAKESIDE DAM

2

PLATE 3



SECTION THROUGH TIMBER
SPILLWAY
LAKESIDE DAM

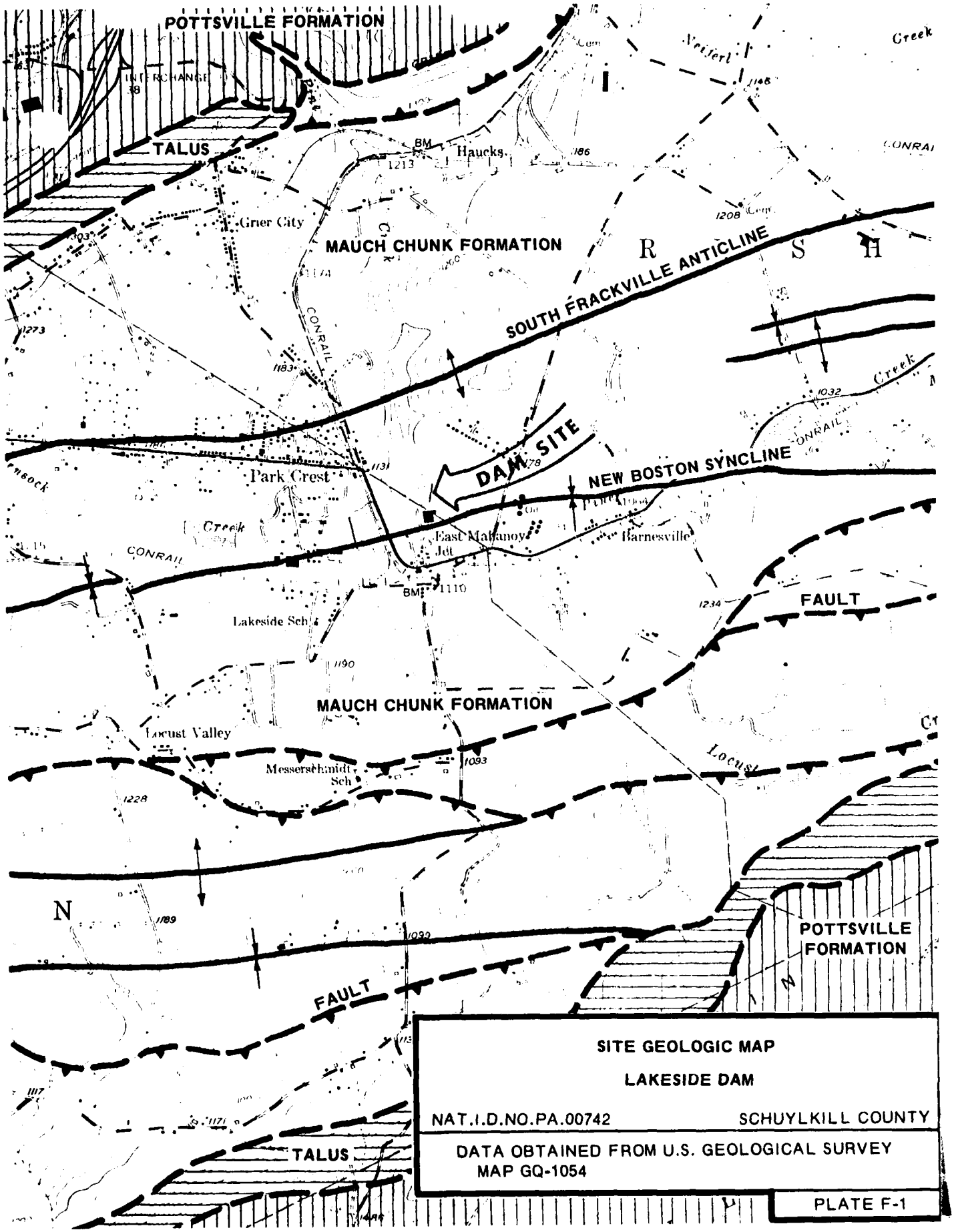
PLATE 4

APPENDIX

F

SITE GEOLOGY
LAKESIDE DAM

Lakeside Dam is located in the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. As shown in Plate F-1, the dam is constructed upon the Mauch Chunk Formation of Upper Mississippian age. The Mauch Chunk consists of red-brown sandstone units having shale and siltstone interbeds, and red-brown shale and siltstone units having sandstone interbeds. Bedrock is exposed along the right side of the right spillway channel. Here shale and siltstone beds strike approximately east-west (perpendicular to dam axis) and dip 29 degrees to the south (towards right abutment). Bedrock jointing strikes N 20° E and dips near vertical to the northwest. The dam is located on the northern limb of the east-westerly trending New Boston Syncline (downfold). A small east-west striking fault which dips 43 degrees to the south is exposed in the bottom of the right spillway channel. The geologic structures in the immediate dam vicinity reflect the overall regional character of the Broad Mountain Anticlinorium in which the dam is located. Any potential seepage related to bedrock conditions would most likely be enhanced by the nearness of bedrock to the ground surface and the bedding crossing the dam axis at approximately a right angle.



SITE GEOLOGIC MAP

LAKESIDE DAM

NAT.I.D.NO.PA.00742 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY
MAP GQ-1054

PLATE F-1


DATE
FILME
-8